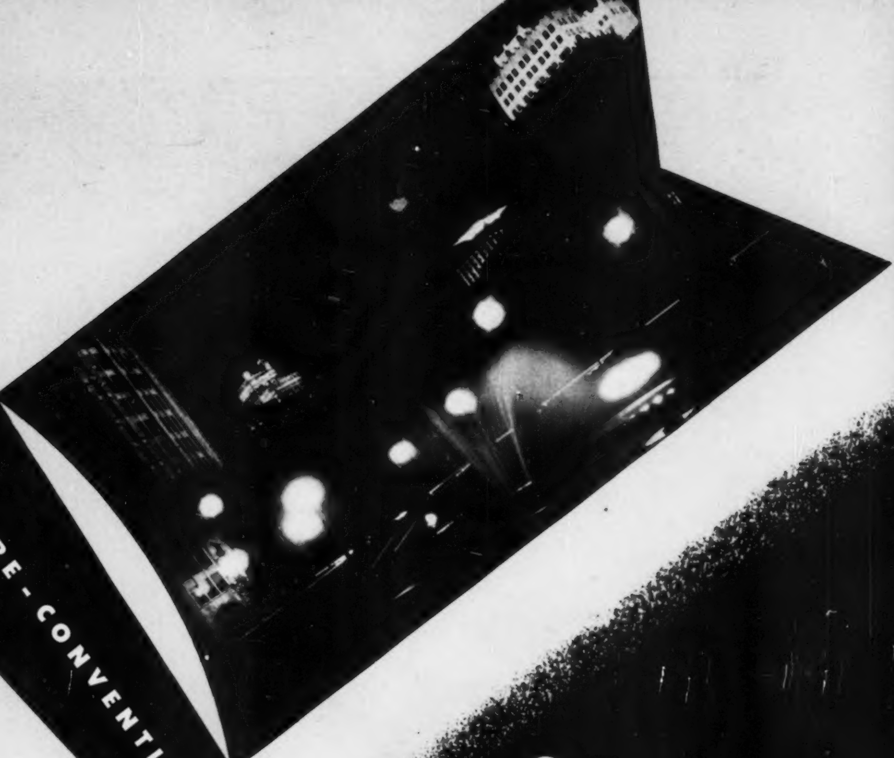
APRIL 1949

PRE-CONVENTION ISSUE

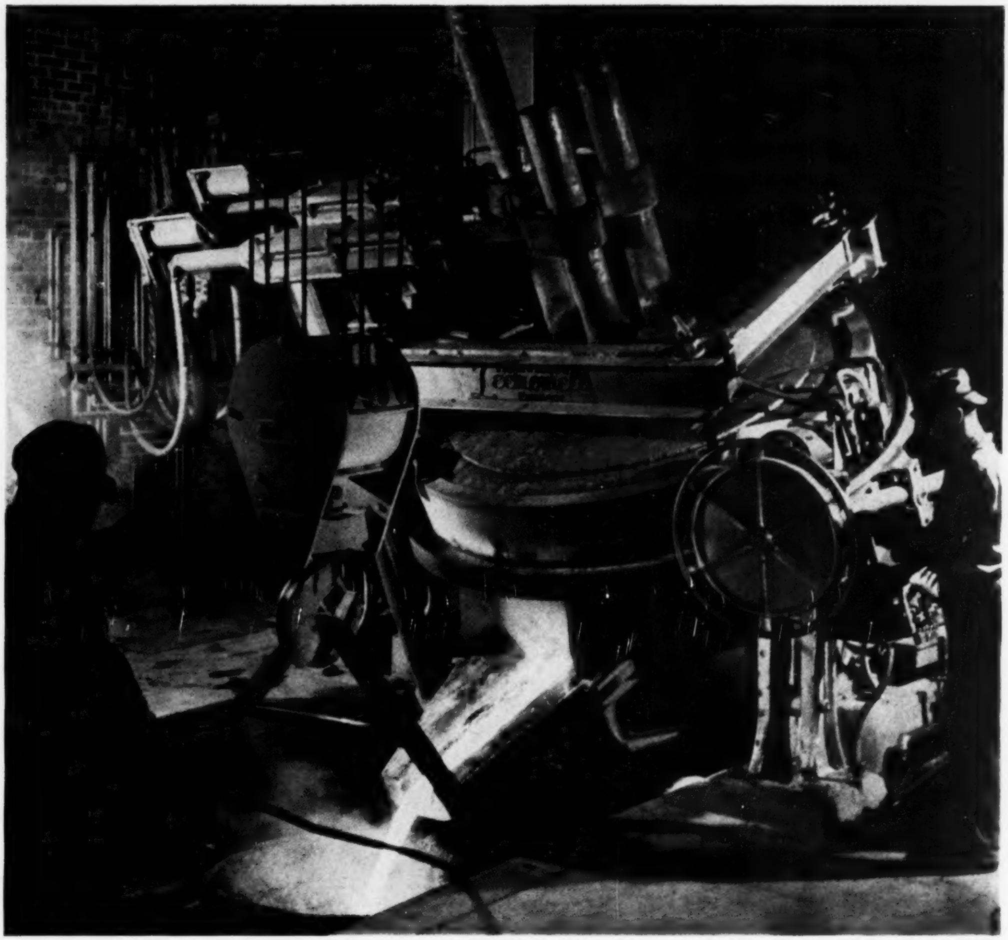


ST. LOUIS

May 2-5

American Foundryman

The Foundrymen's Own Magazine



FOR all-around efficiency and economy in furnace performance, the Moore Rapid Lectromelt Furnace, Size PT, pictured here is unsurpassed. It produces up to six tons per heat with a KVA rating of 2000 to 2500. It permits the making of iron and steel from almost any grade of scrap as well as the melting and refining of special alloys, nickel and copper. It is equipped with the famous patented Lectromelt counterbalanced electrode arm control system which provides the utmost in accuracy and flexibility.

Lectromelt furnaces are made in sizes ranging from 250 pounds to 100 tons capacity. Write today for complete details.

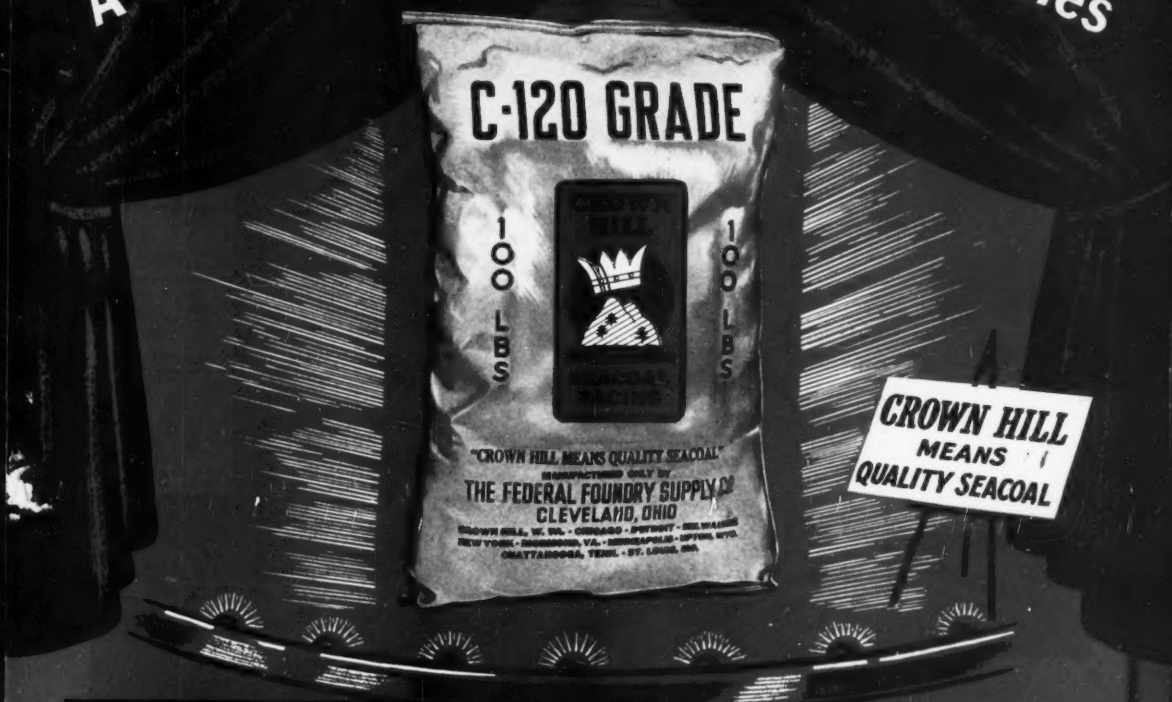
PITTSBURGH LECTROMELT FURNACE CORPORATION

PITTSBURGH 30, PENNSYLVANIA

Lectromelt

manufactured in: CANADA, Lectromelt Furnaces of Canada, Ltd., Toronto 2; ENGLAND, Birlec, Ltd., Birmingham; SWEDEN, Birlec Elektkougnar A B, Stockholm; AUSTRALIA, Birlec Ltd., Sydney; FRANCE, Stein et Roubaix, Paris; BELGIUM, S. A. Belge Stein et Roubaix, Bressoux-Liege; SPAIN, General Electrica Espanola, Bilbao; ITALY, Forni Stein, Genoa.

A STAR PERFORMER in All Foundries



FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.

PROXIMATE ANALYSIS

ULTIMATE ANALYSIS

★ Star performer Crown Hill Sea[illegible] has real foundry appeal:

A. It vents the mold [illegible]

B. Eliminates hard spo[illegible]

C. Makes peeling easy.

There's a reason, in fact three reasons for these advantages: (1) Crown Hill is made from selected, high volatile flash coal; (2) it has extremely low sulphur content; (3) the fusion point of the little ash residue is 2980 degrees F.

Crown Hill does cut cleaning costs substantially. Try Crown Hill Seacoal Facing . . . made by the long-time friend of the foundries—The Federal Foundry Supply Company.

THE FEDERAL FOUNDRY SUPPLY COMPANY

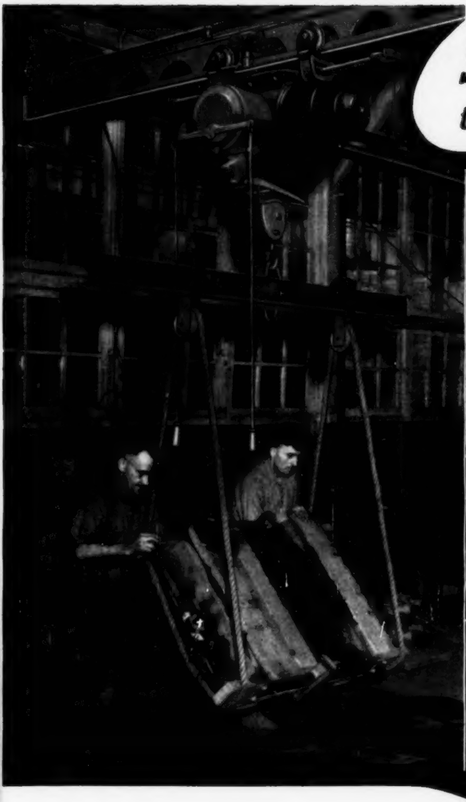
4600 East 71st Street · Cleveland 5, Ohio

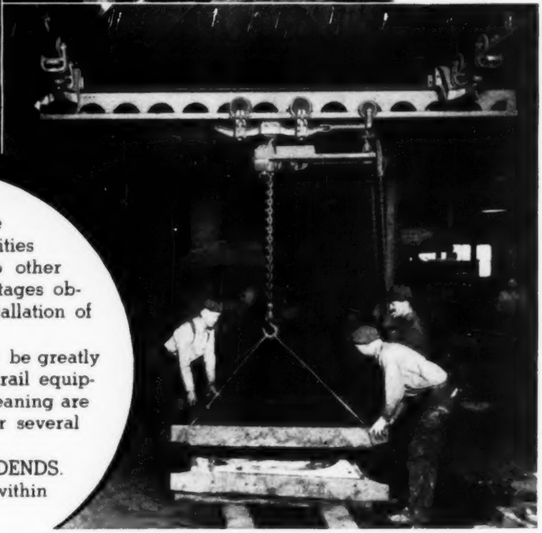
Seacoal Plant

CROWN HILL, W. VA. · CHICAGO · CHATTANOOGA, TENN. · DETROIT · MILWAUKEE · NEW YORK · ST. LOUIS · RICHMOND, VA. · UPTON, WYO.

IN TWIN CITIES: The Foundry Supply Co., Inc., 404 South Third St., Minneapolis 15, Minn.

SPEED MOLD-MAKING
the efficient Cleveland Tramrail Way

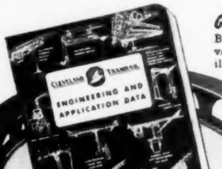




Wherever materials of any kind in a foundry are lifted, moved or handled, there usually are possibilities for effecting important economies. Probably in no other way can so much be saved and as many advantages obtained for such a small investment as through installation of proper materials handling equipment.

Mold-making is one of the many jobs that can be greatly eased and speeded with overhead Cleveland Tramrail equipment. Pouring, sand-handling, cupola-charging, cleaning are others. Often the same equipment can be used for several different purposes.

Cleveland Tramrail pays dividends — BIG DIVIDENDS. Most installations pay for themselves out of savings within one year; some in less than six months.



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BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION

THE CLEVELAND CRANE & ENGINEERING CO.

1206 East 286th St. Wickliffe, Ohio.

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CONTENTS

VOLUME XV, NUMBER 4

American Foundryman

April, 1949

Official publication of American Foundrymen's Society

Published monthly by the American Foundrymen's Society, Inc., 222 W. Adams St., Chicago 6. Subscription price in United States, Canada and Mexico, $3.00 per year; international, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois.


proves Swing
Left: At Layne & Bowler, Inc., Memphis, Tenn., 2800 pound table loads of water pump and well castings are cleaned in 3 to 5 minutes on this 72" Wheelabrator Swing Table.
Ce[illegible]: Cleaning base for typesetting ma[illegible]ne on a 66" Wheelabrator Swing Ta[illegible] at Fairview Foundry Co.
[illegible]72" Wheelabrator Swing Table [illegible] at Iroquois Foundry Co.
Get these big advantages with a WHEELABRATOR Swing Table
1. REPLACES THE AIRBLAST ROOM — handles at least 80% of this class of work.
2. HANDLES WIDE RANGE OF WORK — for shops desiring a versatile general-purpose machine.
3. HYGIENIC — the operator works outside the cabinet.
4. AIRLESS — for faster, cheaper, more efficient production
5. SAVES POWER, LABOR, SPACE.

WHEELABRATOR® PERFORMANCE you can break "PAR" with Table's *FASTER* cleaning

You may say, "Sure, the Wheelabrator cleans faster, cheaper, and more effectively, but what else will this machine do for me?"

The Swing Table does give you other important advantages. For example:

It replaces the Airblast Room because it will handle at least 80% of the work normally cleaned this way. Result — it ends high cleaning cost and laboriously slow production inherent in Room operation. It removes the operator from the dusty confines of the blast chamber.

The Swing Table requires less air for ventilation, is far less costly to erect and install, and takes less power to operate.

Equally important — for the shop that needs moderately priced equipment or where daily production does not warrant several different types of cleaning equipment — is the fact that the Swing Table is versatile and effectively handles a wide range of large or small pieces.

The Swing Table is an exclusive *American* development that has been a boon to a long list of foundries of every size. The advantages it offers are well worth investigating. Full details on all five sizes are given in Catalog 214-A which we will gladly send upon request.

Here's what WHEELABRATOR Swing Tables are doing for others

COMPANY	SIZE MACHINE	PRODUCTS CLEANED	LOADS	CLEANING TIME	EQUIPMENT REPLACED	RESULTS
SESSIONS FOUNDRY COMPANY Bristol, Connecticut	86"	Gray iron castings . . . 25 to 500 lbs. each	Up to 5000 lbs.	4 min. each side	Airblast room, 2 Tumbling Mills	Substantial savings in time and money
McNALLY-PITTSBURG FOUNDRY Pittsburg, Kansas	86"	Steel casting for mining machinery up to 2600 lbs. each	Up to 5000 lbs.	8 to 15 min.	Airblast Room	4 hr. cleaning job on 72" sheave cut to 15 min.
CHEMUNG FOUNDRY CO. Elmira, New York	66"	Gray iron jobbing castings from 1 to 400 lbs. each	Up to 1500 lbs.	3 min. each side	3 tumbling mills and considerable air blast room time	Decreased handling and provided faster, more economical cleaning
MANUFACTURERS FOUNDRY CO. Waterbury, Conn	66"	Gray iron jobbing castings 5 to 750 lbs. each	7 truck engine heads	3 min. per side	10' x 12' Airblast Room	Cleaning costs reduced — more uniform finish on castings
FAIRVIEW FOUNDRY COMPANY Poughkeepsie, N. Y.	66"	Gray iron castings from 1 to 400 lbs. each	Up to 1500 lbs.	4 min.	Airblast room and table and 3 tumbling mills	8 hour cleaning job reduced to 3 hrs.
IROQUOIS FOUNDRY CO. Racine, Wisconsin	72"	Gray iron jobbing castings	Up to 2500 lbs.	3 to 5 min.	Airblast room and 2 tumbling mills	Eliminated 4 men, cut cleaning time from 25 min. to 5 min.

The new Swing Table Catalog No. 214-A graphically describes the speed, economy and versatility of all five Swing Table sizes. Send for your free copy today.

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American

WHEELABRATOR & EQUIPMENT CORP.

(FORMERLY AMERICAN FOUNDRY EQUIPMENT CO.)

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WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

BETTER CORES = BETTER CASTINGS

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Krause Cereal Binders are made under time-tested formulas — their uniform quality is laboratory controlled.

Get the binder advantages you need and want — specify TRUSCOR if you like light weight; AMERIKOR if you prefer the heavy weight. Order from the distributors listed below or direct from us.

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World's largest dry corn millers.

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"ELECTROMET" VANADIUM

Trade-Mark

FOR THE PRODUCTION OF FINE STEELS

VANADIUM GIVES STEEL . . .

- ★ HIGH STRENGTH
- ★ INCREASED DUCTILITY
- ★ GOOD WELDABILITY
- ★ ABRASION RESISTANCE
- ★ TOUGHNESS

Springs, axles, and other parts of the trucks of high-speed diesel locomotives are made of vanadium steel. Vanadium is also used in steel for tools and machinery parts because of the exceptional properties that it imparts.

Vanadium improves steel by increasing its yield strength and its ductility. Vanadium-bearing steels are tough—because of their uniformly fine grain size – and resist abrasion, fatigue, and impact. They are especially suitable for parts subject to high dynamic stress.

Vanadium steels are readily cast, forged, and rolled. They are also easily machined, and have exceptional weldability. When vanadium is added to steel in quantities ranging from 0.05 to 0.20%, heat-treatment is simplified. Its use results in a tough, strong, wear-resisting surface on case-carburized parts.

ELECTROMET ferrovanadium is made especially for the manufacture of fine steels for tools and machinery parts. This ELECTROMET alloy contains 50 to 55% vanadium and is available for immediate delivery in grades containing maximum 0.20%, 0.50%, or 3.00% carbon. It is furnished in various crushed sizes suitable for all open-hearth and electric-furnace additions.

Our staff of competent metallurgists is always ready to furnish on-the-job technical assistance in the use of vanadium and other ELECTROMET ferro-alloys and alloying metals. Write to the nearest ELECTROMET office.

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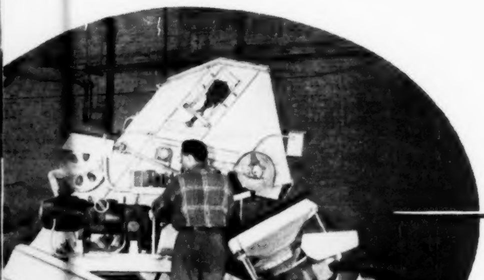
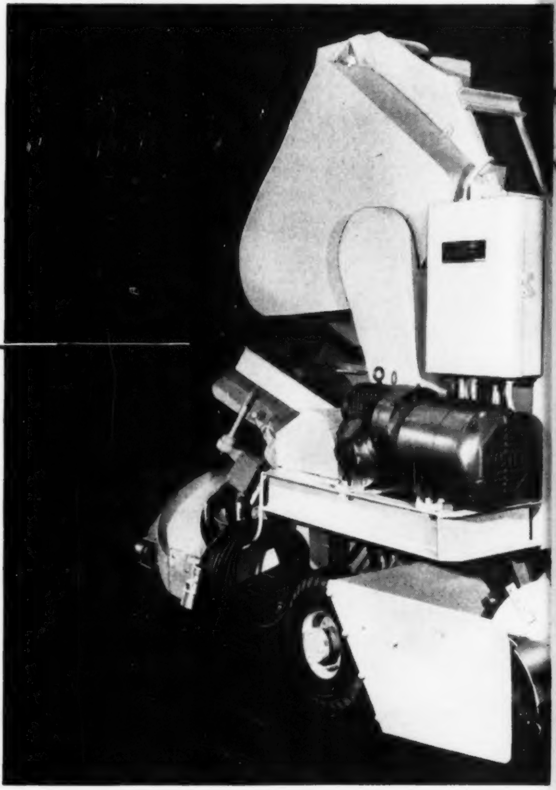
New the NITE-GANG for

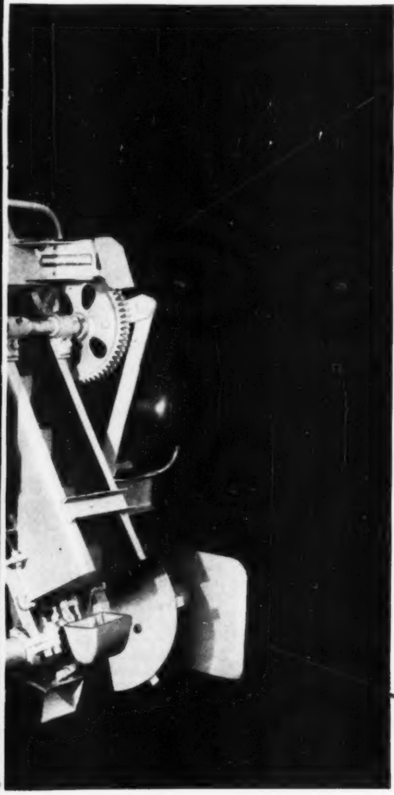




1. Maneuvered by its simple, centralized controls the Nite-Gang travels under its own power to any floor in the foundry. On reaching the floor to be conditioned the Nite-Gang is slowed to the proper crowding speed, the elevator column is lowered and the machine is moved into the unprepared sand for loading.

2. As the Nite-Gang moves into the unprepared sand, the rotating spiral completely blends all of the sand in its path and conveys it to the bucket elevator. The buckets elevate the blended sand and discharge it onto the magnetic separator which removes the scrap from the sand before screening . . . even iron shot too small to be removed by a riddle is magnetically separated.

complete sand conditioning



ONLY THE NITE-GANG OFFERS THESE 10 IMPORTANT FEATURES

Self Propels • Self Loads—Without Prior Windrowing • Blends • Magnetically Separates • Breaks Lumps and Screens • Double Aerates • Windrows or Piles • Travels and Loads at Variable Speeds • Leaves a Clean Level Floor • Extremely Maneuverable

SEND FOR THE NEW NITE-GANG BULLETIN!

BEARDSLEY & PIPER
Division of
PETTIBONE MULLIKEN CORPORATION
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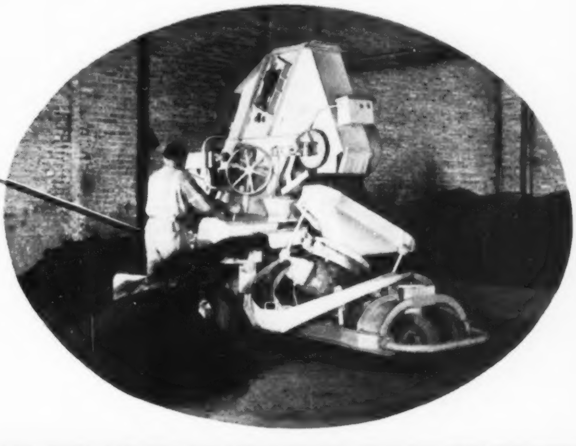
Beardsley & Piper are manufacturers of the Sandslinger • Speedslinger • Hydra-Slinger • Speedmullor • Mulbaro • Screenarator Nite-Gang • Junior Nite-Gang • Preparator • Champion Speed-Draw • Plate Feeders • Turntables • Gyratory Screens



3. The blended, iron free, sand is discharged into the M5 Screenarator Unit which screens, double aerates, and discharges the completely conditioned sand to any desired distance within forty feet.

The Screenarator Unit is mounted on a swivel base, permitting the sand to be windrowed or piled at either side of, or behind the machine within an arc of 240 degrees.

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keep production rolling . . . .

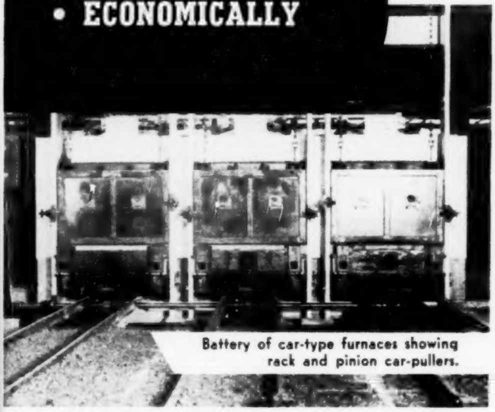
- SMOOTHLY
- PRECISELY
- ECONOMICALLY

GAS • OIL • ELECTRIC • DIRECT FIRED AND RECIRCULATING

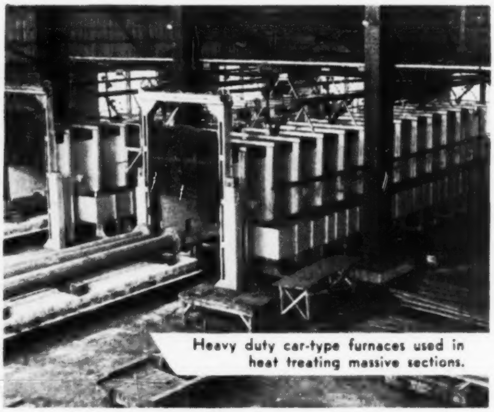
Salem builds car-type furnaces for long cycle annealing, normalizing, stress relieving or hardening of finished or semi-finished material. We build any size or style of car-type furnace that you may need to improve your production.

BUILT TO YOUR SPECIFICATIONS

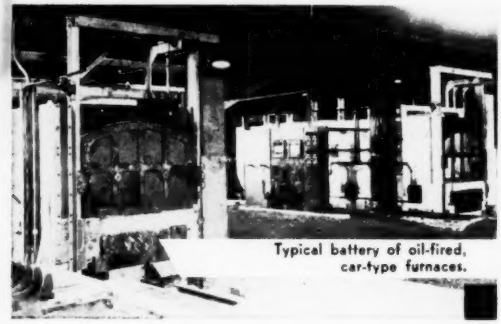
All Salem furnaces are designed and built to customer's specification for smooth, precise and economical operation. Keep your quality up and your costs down with Salem car-type furnaces.



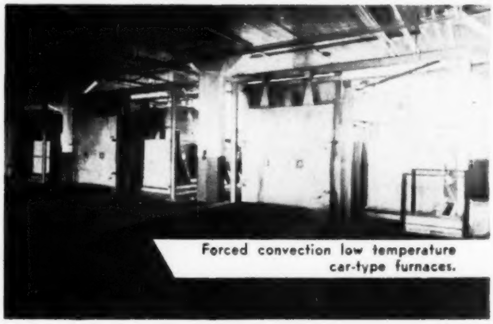
Battery of car-type furnaces showing rack and pinion car-pullers.



Heavy duty car-type furnaces used in heat treating massive sections.



Typical battery of oil-fired, car-type furnaces.



Forced convection low temperature car-type furnaces.

SALEM ENGINEERING COMPANY

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HEADQUARTERS FOR HEAT TREATING DESIGN

Salem, Ohio *Southwest Office, Fort Worth, Texas*

SALEM ENGINEERING (CANADA), LTD., TORONTO, ONTARIO
SALEM ENGINEERING COMPANY, LTD., MILFORD, NR. DERBY, ENGLAND

SPECIFY THIS POWERFUL, POSITIVE INNOCULANT

NISILOY*

to eliminate hard chilled areas in gray iron castings

... *REDUCE machining time, tool wear, rejections*

Produce *machinable* gray iron castings regardless of sharp variations in section thickness...

Eliminate localized hard areas or chilled (white) edges and surfaces...

Reduce machining time, tool wear and rejections... *raise both quality and quantity of your output by controlling gray iron structure with small ladle additions of NISILOY.*

Designed specifically to promote better machinability, NISILOY is a powerful innoculant and graphitizer containing about 60% Nickel, 30% silicon, balance essentially iron.

**Trade Mark of The International Nickel Company, Inc.*

Mail the coupon now... for your *free* copy of a booklet that describes how Nisiloy helps you improve structure and machinability of gray iron castings.

EMBLEM OF INCO SERVICE

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Please send me your booklet entitled,
"NISILOY" for GRAY IRON CASTINGS.

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Company..
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City..*State*....................

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OTHER TIME-PROVEN

Famous CORNELL MOLTEN METAL FLUXES

FOR BRASS

Famous CORNELL BRASS FLUX

To get the best brass castings it is a *must* that you pour clean metal.

Famous Cornell Brass Flux is a metal conditioner. It makes metal pure and clean even when the dirtiest brass turnings are used.

It pays off in tougher, sounder and denser grained castings that stand the pressure test and take an extra fine finish.

Several elements in this flux combine to gather the gases, while the metal is being melted, and cause them to form into balloon shaped bubbles and rise to top of metal in the form of slag which is very essential as a cover to retain heat during transfer to molds.

Less tin and other metals are required.

Crucible and furnace linings are kept clean and preserved.

FOR ALUMINUM

Famous CORNELL ALUMINUM FLUX

This flux causes rapid elimination of impurities from molten aluminum so that you get greatly improved castings.

It permits the use of more scrap without danger of dirt, porous places or spongy spots.

Thinner yet stronger sections can be poured.

It improves working conditions. Exclusive formula greatly reduces obnoxious gases.

The dross does not contain any metal after flux is used.

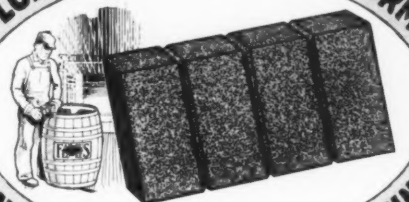
WRITE FOR BULLETIN 46-A

MALLEABLE FOUNDRIES *with* CUPOLA OPERATION

are showing a rapid trend towards the use of Famous Cornell Cupola Flux. Reports of better castings due to the thorough cleansing action of this flux, and reduced cupola maintenance are coming from every direction. Famous Cornell Flux not only insures cleaner cupolas, cleaner drops, but forms a glazed or vitrified film over cupola lining, which reduces erosion and prolongs the periods between patching or replacement of brick or stone.

Try them -- **SEEING IS BELIEVING !**

FLUX IN SCORED BRICK FORM



SAVES TIME AND LABOR IN USING

Famous
CORNELL CUPOLA FLUX
31st ANNIVERSARY

IRON,

SEMI-STEEL,

MALLEABLE,

BRASS,

BRONZE,

ALUMINUM,

AND

LADLE

FLUXES

We're proud of our contribution to CLEAN METAL . . BETTER CASTINGS

THE REGULAR USE of Famous Cornell Cupola Flux has resulted in untold savings to the foundry industry by reducing rejects and shipping delays caused by make-overs. Iron is purged of impurities, is hotter and more fluid, and sulphur is greatly reduced.

THE CASTING BUYER is quick to notice a good job. He appreciates castings that are sound, clean and amazingly free from hard spots, chilled sides, etc. He not only saves time and money in machining but pleases his customers with a better product.

YOUR CUPOLA OPERATION, too, is greatly improved. Famous Cornell Flux keeps cupolas cleaner, bridging over is practically eliminated, drops are cleaner, and maintenance labor is greatly reduced.

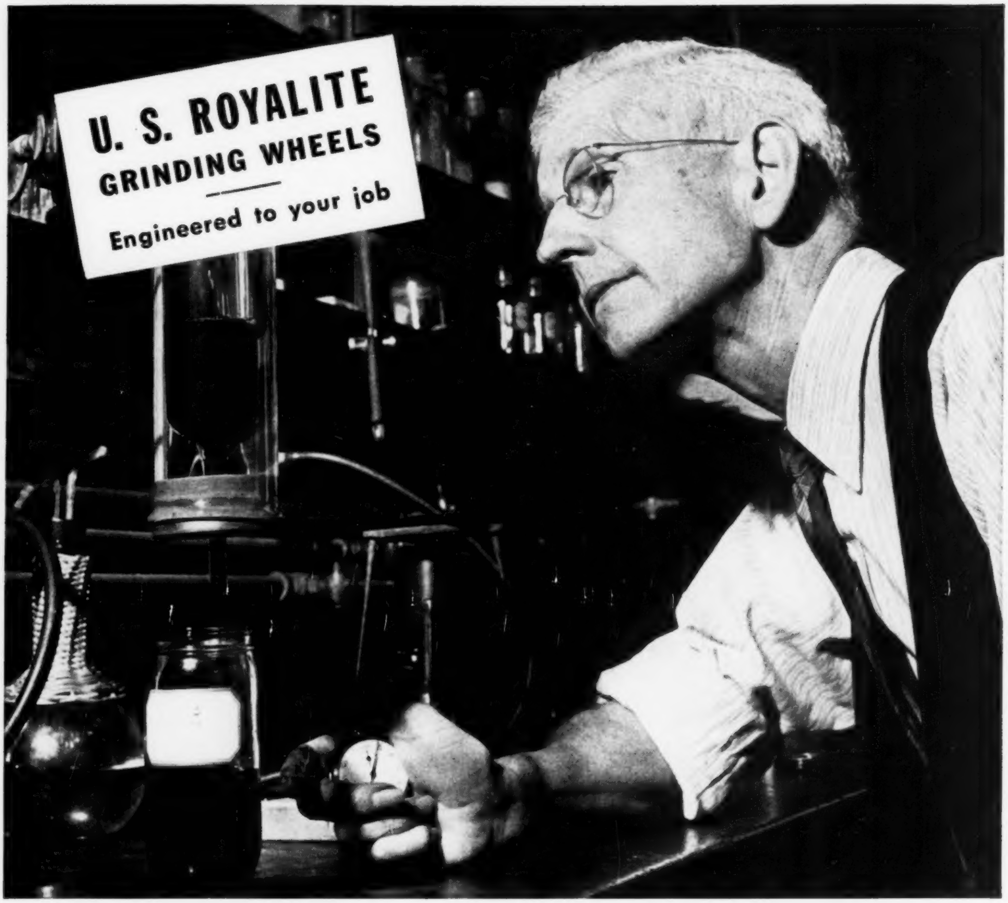
SCORED BRICK FORM makes Famous Cornell Cupola Flux by far the easiest to use. It eliminates digging out of container, measuring, weighing and waste. You simply toss this flux into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges. Famous Cornell Cupola Flux, being in solid form, does not blow out with the blast but STAYS in melting zone until entirely consumed, hence you get the full benefit of the amount used.

WRITE FOR BULLETIN 46-B

FAMOUS FORMED FLUXES
Trade Mark Registered

The CLEVELAND FLUX *Company*

1026-1036 MAIN AVENUE, N. W., CLEVELAND 13, OHIO



An old timer talks about Grinding Wheels...

You're looking at a test of the kinetic viscosity of liquid resin—one of many tests made to be sure you get a grinding wheel that is just what you've asked for . . . and more.

The purpose is always the same—*more production at lower cost*. We draw from our immense research facilities in every conceivable phase of abrasives and bonds. In addition, we have at our disposal the vast research data covered by the thousands of other products made by United States Rubber Company.

That is why we can deliver U. S. Royalite Grinding Wheels that are precisely engineered to your job, whether you're snagging castings, grinding ball races or working with billets, bits, slabs or sauce-pans. We can give you accurate grinding wheel costs in advance—by means of thorough field tests made by our engineers right in your own plant.

For more information, write United States Rubber Company, Grinding Wheel Dept., Fort Wayne 4, Indiana.

U. S. GRINDING WHEELS—ORIGINATED IN 1863

PRODUCTS OF

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

USE *Davenport*

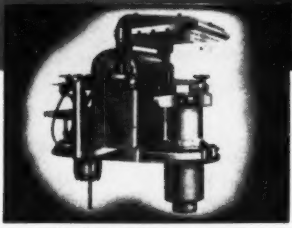
FOUNDRY MOLDING MACHINES

TO GIVE YOU **Better Castings**

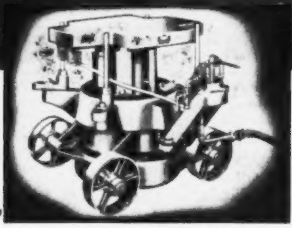
IN LESS TIME - AT LESS COST

Productive Capacity . . . of your employees in the molding department is increased with Davenport molding machines.

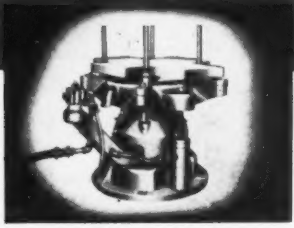
Reduce Physical Labor . . . with Davenport molding machines. They make your employees more satisfied with their jobs.



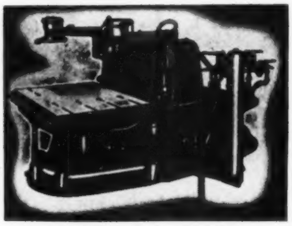
Jolt Rollover Draw, Model A
(6 sizes)



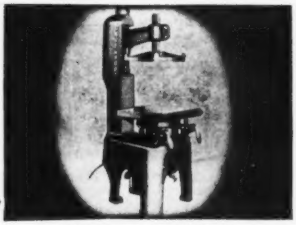
Jolt Pin Lift, Model AJS
Portable (5 sizes)



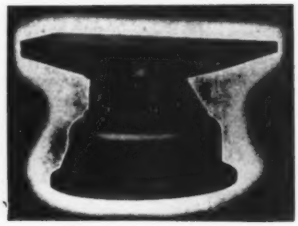
Jolt Pin Lift, Model AJS
Stationary (5 sizes)



Jolt Rollover Draw, Model SA
(6 sizes)



Jolt Squeeze, Model 10-JX
Portable and Stationary



Plain Jolter, Model AJ-RJ
(34 sizes)

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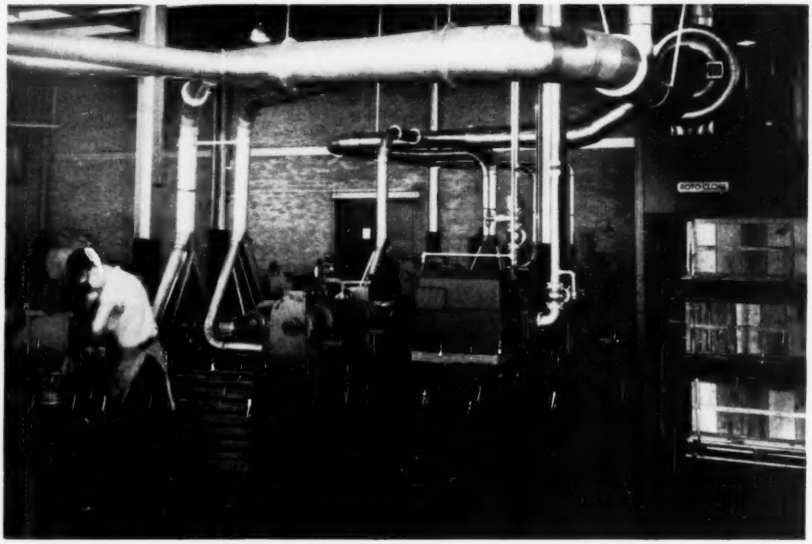
ROTO-CLONE gives dust a One-Way Ticket



Battery of stand grinders used for foundry snagging operations is served by two Type D Roto-Clones.

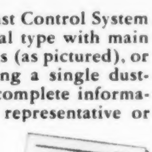
DUST can't linger here to cloud the atmosphere, foul-up equipment and irritate workers. The moment it is generated, it's on its way out via Roto-Clone*.

This battery of stand grinders used for snagging castings is served by two Type D Roto-Clones installed back to back. Note the compactness of the installation. Location of the Roto-Clones at dust source eliminates long, costly pipe runs.

Constant efficiency, uniform air volume, small space requirement, low cost and ease of installation—these are the features of the Type D Roto-Clones that have made this unit a leader in the industry's winning battle over dust.

A Type D Roto-Clone Dust Control System may be installed as a central type with main duct and branch connections (as pictured), or as an individual unit serving a single dust-producing operation. For complete information, call your local AAF representative or write direct to:

IT'S A FACT! More grinders are exhausted by the Type D Roto-Clone than any other type of dust collector. Bulletin No. 272 A tells the story. Write for it now!



MEMBER FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, INC.

AMERICAN AIR FILTER COMPANY, INC.

104 Central Avenue, Louisville 8, Ky.

In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT

**Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.*

CHICAGO, ILLINOIS
SAINT JOSEPH, MICHIGAN
KOHLER, WISCONSIN
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a REVOLUTION
IN DIE CASTING!
New Lindberg-Fisher 2 Chamber Melting Furnace revolutionizes die casting methods. Typical users throughout the country say:
Floyd J. Kamin, President, Kamin Die Casting & Mfg. Co., says: "On this job our new Lindberg-Fisher Induction Melting Furnace turns out twice as much work as a conventional gas furnace with the same melting capacity—and rejects have decreased 65%. We operate continuously, and we find that cost is actually less than with a gas furnace of the same melting capacity."
Edward L. Kornayzer, Kamin Plant Supt., says: "The furnace operates much cooler and operator fatigue is practically eliminated."
Roe F. Reed, President, Reed Metal Crafts, says: "We're more than satisfied with our Lindberg-Fisher melting furnace. We've ordered another and plan to install more in the future."
The Chief Engineer of a well known Chicago manufacturer of aluminum and zinc die cast products says: "Working conditions for our operators have been greatly improved because of lower temperature in the immediate area of the furnace. Furnace shell is so cool that you can touch it with bare hands. We also find that molten metal is noticeably cleaner and dross loss is considerably reduced.
LOS ANGELES, CALIFORNIA
Here are some of the many reasons why you, too, will want a Lindberg-Fisher 2 Chamber melting furnace in your plant . . .
Double Chamber permits simultaneous cold metal charging and ladling . . confines impurities to the charging chamber . . provides gentle magnetic fluxing . . . reduces metal losses.
"Channel Flushing," new patented feature flushes channels twice a minute eliminating channel clogging. Automatic temperature control is amazingly precise—permits the lowest possible casting temperatures. Cool operation improves working conditions.
Write for the address of the Lindberg-Fisher installation nearest you. See the furnace in operation, hear for yourself how the men who run them feel about this revolutionary new furnace
LINDBERG-Fisher MELTING FURNACES
Lindberg Engineering Co., 2440 W. Hubbard St., Chicago, Ill.
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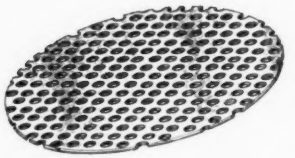
NEXT MONTH—Hand ladling will soon be obsolete.
Completely automatic nitrogen ladling.
Look for our advertisement.

Chicago

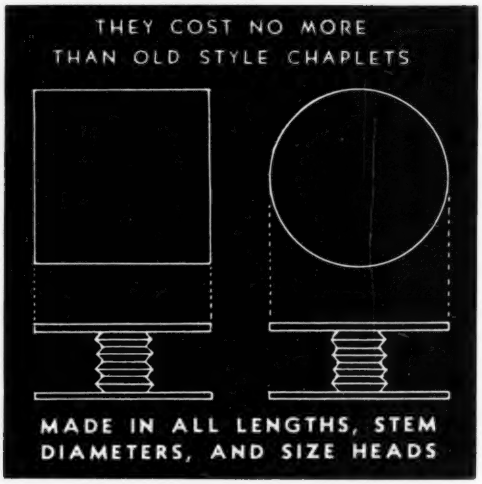
CHAPLETS and CHILLS

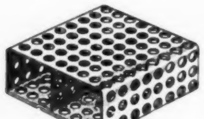


For over thirty years, Chicago Chaplet Co. has been supplying the foundry trade with the finest and most complete line of chaplets, chills and allied items.

We have worked constantly to improve our products. We have carefully maintained adequate facilities and sufficient stock to assure prompt delivery of all orders. That's why today Chicago chaplets and chills are known and used throughout the country.

Remember—chaplets and chills are small items—but they are important factors in the production of quality castings. Choose them with the same care that you use in the purchase of your major foundry equipment.





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2047-2059 NORTH WOOD ST. CHICAGO 14, ILLINOIS

Men, methods, machines and materials are vitally important factors in the efficient, economical operation of any foundry. They are equally as important to the successful conduct of our business which for over half a century has been devoted to serving the Foundry industry with better equipment and supplies.

That's why experienced, responsible foundrymen through the years have come to look upon Stevens as the one dependable source of supply with whom they could concentrate the bulk if not *all* of their foundry equipment and supply purchases. Knowledge born of experience in doing business with Stevens has proved the wisdom of this decision. It's something for you to think about.

One thing you can be sure of, whether it's equipment bearing another maker's name, or a foundry facing material made in our own mill, the superior quality of each product recommended and sold by Stevens is your assurance of utmost efficiency and absolute dependability in that phase of your foundry operation wherever applied.

To call on Stevens is to make *a good connection.* It gives you a direct line to fast action on *all* of your foundry problems. You get the assistance of experienced Stevens field representatives, technicians and foundry production specialists who have but one creed "let's try to do it better for less." Yes, if it's *anything* for a Foundry—Stevens has *everything* you need!

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use CYCOR*151 synthetic resin binder

for sand cores and dry molds

Cycor 151 gives foundries 33% to 50% faster baking time than old-time binders—at baking temperatures of only 350°F. This means positive savings in production and BTUs.

The use of Cycor 151 improved synthetic resin binder for sand cores and dry molds also means many other advantages in the production of cleaner, more uniform castings. Good collapsibility. Elimination of expensive clean out.

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And don't forget this: with Cycor 151, you purchase *only* the neat synthetic resin; you can modify this resin with fillers or extenders to meet your particular requirements.

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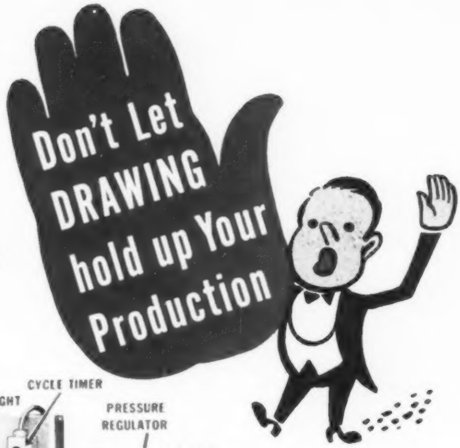
AMERICAN *Cyanamid* COMPANY

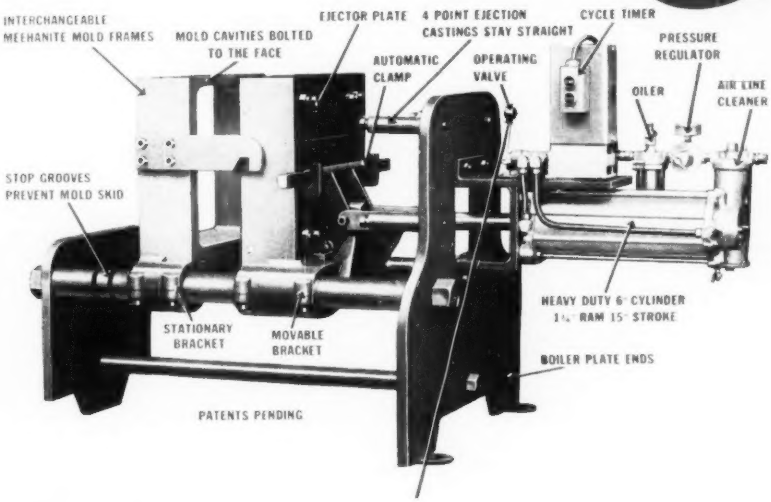
PLASTICS DEPARTMENT

30-36 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

MASTER PNEUMATIC DRAW TABLE

for Aluminum Permanent Molds





Open, Close, Clamp & Reject Casting with ONE LEVER!

The perfected, foolproof Master Pneumatic Draw Table—so simple to operate that ONE man can easily work TWO machines . . . and places permanent mold castings on a real quantity production basis! Push one lever and the cavity blocks meet—no clamps to tighten, no further adjustment necessary.

Pour the metal and the automatic timer takes over—releases the cavity blocks and ejects the casting with no attention from the operator.

This Pneumatic Draw Table is now offered at a price that makes even the simplest draw table you produce yourself a pure luxury. Write now for information and prices!

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MEXITE BRIQUETTES STABILIZE CARBON ANALYSIS . . . REDUCE SCRAP LOSSES

Casting losses due to low carbon content can be eliminated with MEXITE BRIQUETTES — specially processed and sized Mexican Graphite held by a fluxing bond. MEXITE BRIQUETTES are the most effective source of carbon to raise and stabilize the carbon content of molten metal, especially when high percentages of steel are charged. MEXITE BRIQUETTES cut casting losses caused by shrinkage, poor fluidity and brittleness, and improve machinability of finished castings. They are easy to use — a specified number of briquettes is added to each charge in accordance to formula. MEXITE BRIQUETTES improve quality, cut production costs. Write for full details.

Mexite Briquettes

THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICH.
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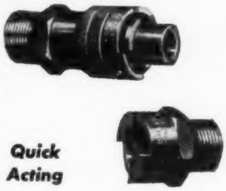
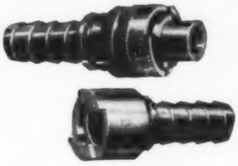


PIPE ENDS

Quick Acting

Machined from solid bar steel and brass; steel is thoroughly rust proofed. Quick-lock sleeve. Male threads in six sizes: from ¼" to 1¼".

HOSE ENDS



Quick locking sleeves prevent accidental uncoupling. Grooved with four serrations on shank for standard hose clamps. Made in six sizes.

Quick Acting

SWIVEL NIPPLES

New Airhose Accessory

Straight and angle type nipples for horizontal or vertical working operations. Permits quick changing of tools. Eliminates hose kink. Increases efficiency.

PIPE ENDS

Quick Acting

Quick-lock sleeve, will not accidentally uncouple. Requires a quarter-turn to lock or unlock. Female threads made in six sizes: from ¼" to 1¼".

Write for Bulletin A 300

AIR VALVES

Pressure seated air valve with male thread at one end, grooved hose shank at other. Provides a convenient shut-off valve within operator's reach.

Made for Hose Size ½" and ¾"

AIR VALVES

Angle permits hose line to fall away from valve and eliminates kinking. Valve has only three parts. Trouble-free construction assures long life.

30° Angle—made in 4 sizes

BLOW GUNS

All of Dallett's Blow Guns are made from brass. The lever valve style is made in two sizes: ¼" and ⅜". Extensively used wherever air is employed.

Lever Style

Button Style

BLOW GUNS

Dallett's shrouded button valve design Blow Gun eliminates possibilities of breaking or bending valve stem. Made from brass in ¼" and ⅜" sizes.

Write for Bulletin A 300

A-300

TOOL MAKERS
PNEUMATIC DALLETT EQUIPMENT ACCESSORIES
SINCE 1883

THE DALLETT COMPANY

MASCHER AT LIPPINCOTT STREET, PHILADELPHIA 33, PA.

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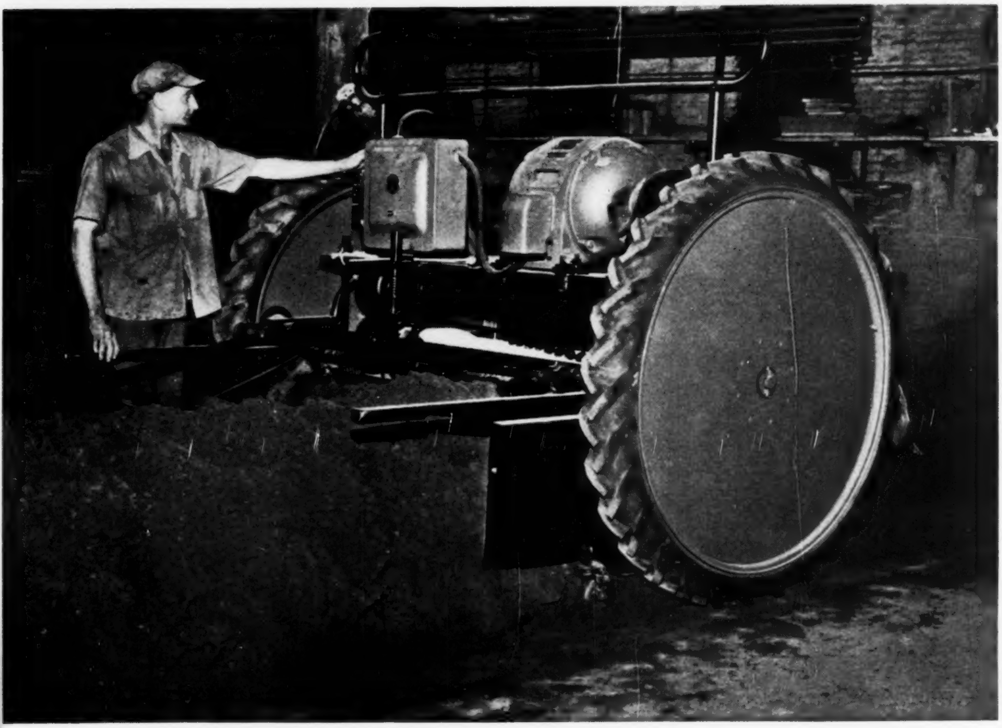
DISTRIBUTORS in principal cities throughout the United States, Canada, Europe and South America.

The New Moulders' Friend
FINDS FRIENDS EVERYWHERE



Moulders like The New Moulders' Friend, because the blending action of the rotary wire brush thoroughly mixes and aereates the sand, making it easy for them to put up more and better moulds.

Night crews like it, because it eliminates much manual labor and does a better job of conditioning the sand.

Sand control men like it, because it does such a thorough job of mixing that they really can control the sand.

Maintenance men like it, because it has few moving parts to keep in order.

Men who buy castings like it, because it gives them better castings with a smoother finish.

You will like The New Moulders' Friend, because it will decrease your scrap and labor costs and will improve the morale of the men in your foundry.

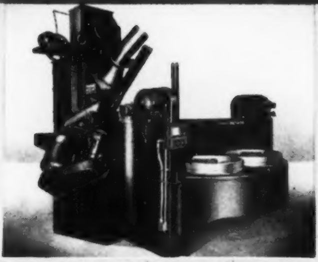
Begin a profitable friendship with The New Moulders' Friend by writing for further particulars.

"The Moulders' Friend"

Sand Conditioning Equipment
Dallas City, Illinois

PANGBORN ROTOBLAST* Gives You All Three!

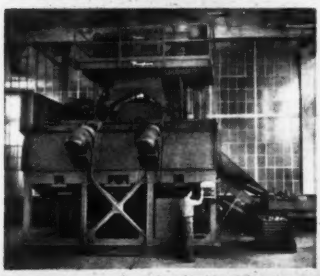
Faster . . . Better . . . Cheaper BLAST CLEANING



The Pangborn ROTOBLAST "LG" Table offers semi-continuous cleaning of work with intricate contours and multi-surfaces. The work is placed on auxiliary work tables which revolve around their own independent axes while passing through blast stream on main table orbit. Blast stream is hurled from 45° angle to clean all exposed surfaces of work. (Other types and sizes available.)

Pangborn ROTOBLAST Barrels give top efficiency in batch method cleaning. They're famous for cost-slashing Pangborn rocker barrel action which turns the work for complete cleaning on all sides. Automatic abrasive recovery mechanism saves abrasive . . . saves you money. Pangborn's automatic loading device saves time and effort in loading. Pangborn ROTOBLAST Barrels are available in a wide range of sizes for large or small foundries.

The Pangborn ROTOBLAST "Table-Room" for all general-purpose types of blast cleaning. Cleans any shape castings weighing but a few pounds, up to large castings 5 ft. by 30 in. weighing $2^1/_2$ tons. It's easy to operate. Put castings on table—close doors—turn on the blast stream. As the table rotates, castings are cleaned quickly while the operator stands outside. This machine cuts jobbing foundry cleaning costs to a par with specialty foundries.



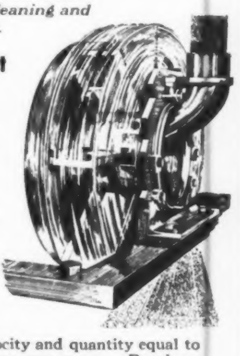
The Pangborn Continuous-Flo ROTOBLAST Barrel offers you uninterrupted, production line blast cleaning. It's the latest blast cleaning development with an unduplicated performance record. Tests show 40% savings over batch method cleaning costs. It's operated by *one* man. Castings are conveyed to feed end, cleaned by two ROTOBLAST streams, discharged ready for sorting and inspection.

CUT your cleaning costs. Speed up blast cleaning bottlenecks with Pangborn ROTOBLAST. It's the modern centrifugal method of hurling abrasive with lowest cost and highest efficiency . . . found only in Pangborn Blast Cleaning Machines.

No matter what your blast cleaning problem, Pangborn has the right ROTOBLAST Machine for your job . . . whether you clean castings, forgings, stampings or miscellaneous metal parts. Perhaps one of these models is your answer. For more information, just clip the coupon and check the bulletins you'd like to read. PANGBORN CORPORATION, 1403 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for all the latest developments in Blast Cleaning and Dust Control Equipment.

ROTOBLAST—The Secret of Top Efficiency



Pangborn's famous ROTOBLAST was developed to clean most effectively at lowest cost per hour of operation.
Cleans faster because it throws more abrasive at a larger area with greater density.
Cleans better because it produces a finer surface than old-style methods.
Cleans cheaper because it requires less horsepower to propel abrasive with velocity and quantity equal to any other method . . . uses less man power . . . Pangborn gives you top blast cleaning efficiency with the right ROTOBLAST equipment for every job.

More than 25,000 Pangborn Machines Serving Industry

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PANGBORN CORPORATION
1403 Pangborn Blvd., Hagerstown, Md.
Gentlemen:
Please send me the following bulletins . . .
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☐ CONTINUOUS-FLO ☐ DUST CONTROL
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COMPANY ....
ADDRESS ....
CITY .... ZONE ...... STATE ....

Pangborn

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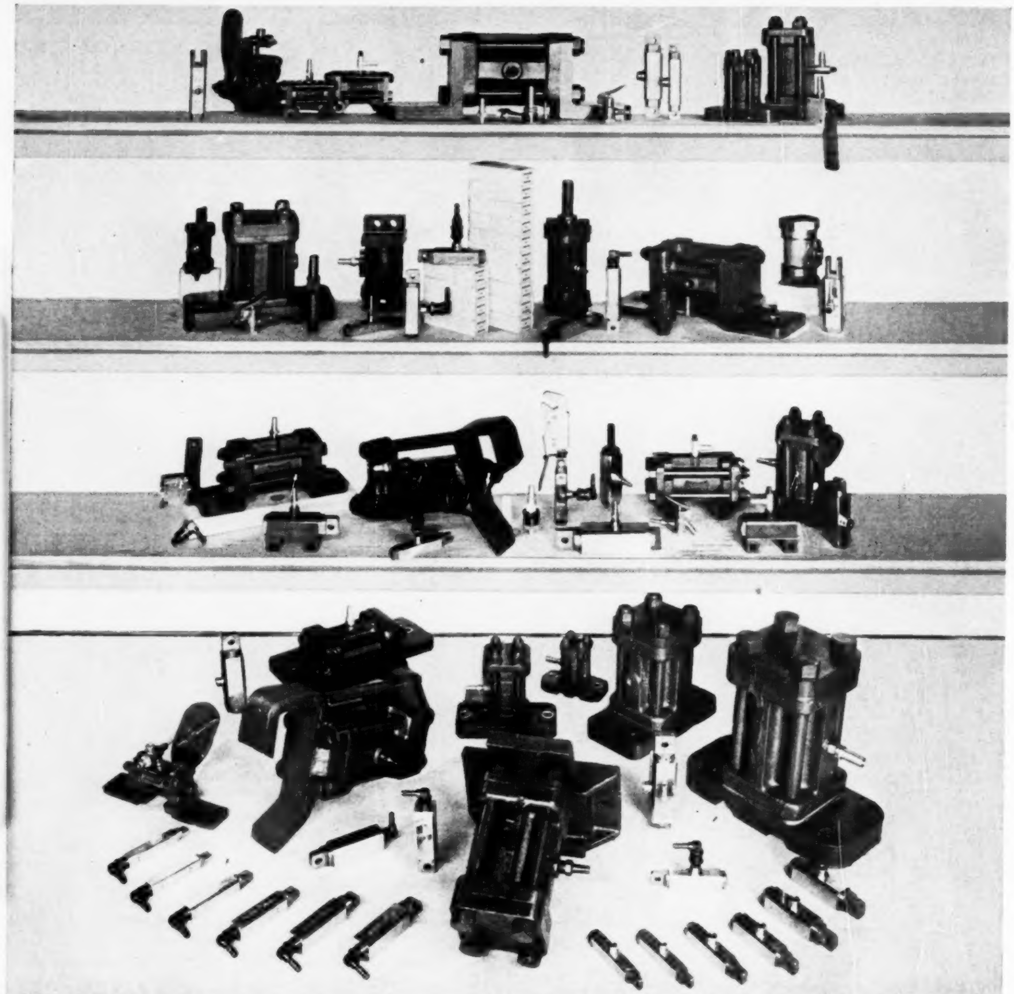
BLAST CLEANS CHEAPER with the right equipment for every job

COMPLETE FINISHED STOCK OF ALL SIZE VIBRATORS TO SUIT *Your* NEEDS



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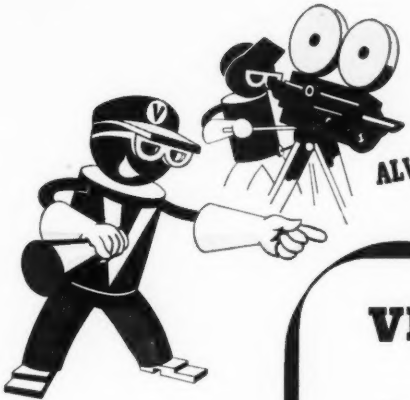
★ 2787 Clinton Avenue Cleveland 13, Ohio ★



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VELSICOL Corporation

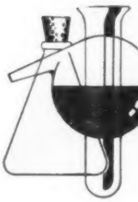
PRESENTS

The Cavalcade of Core Oils

V-40-F Core Oil: Characteristics: Light color, low viscosity, clean workability in the core boxes, fast baking, high strength with good flexibility, rapid collapsibility and low gas evolution . . . To be used with Michigan City, Washed and Dried Silica, Port Crescent and similar sands with not more than 0.5% passing the 200 screen and containing no clay substance . . . For automotive, boiler, gas burner and similar castings in gray iron; for light to medium castings in steel where collapsibility is essential; for all malleable, light metals and brass castings.

Constant Research is the Secret of VELSICOL Superiority

Unlimited technical resources and endless experiment have fashioned VELSICOL'S balanced core oils for every core making problem.



CORE OILS for

- Clean - clay free open sand
- Castings susceptible to hot tears and difficult removal
- Light sectional castings Heavy sectional castings
- Sand containing fines and clay
- Castings requiring cores with high hot strength
- Iron or steel castings Non ferrous castings

"VELSICOL" **VELSICOL Corporation**

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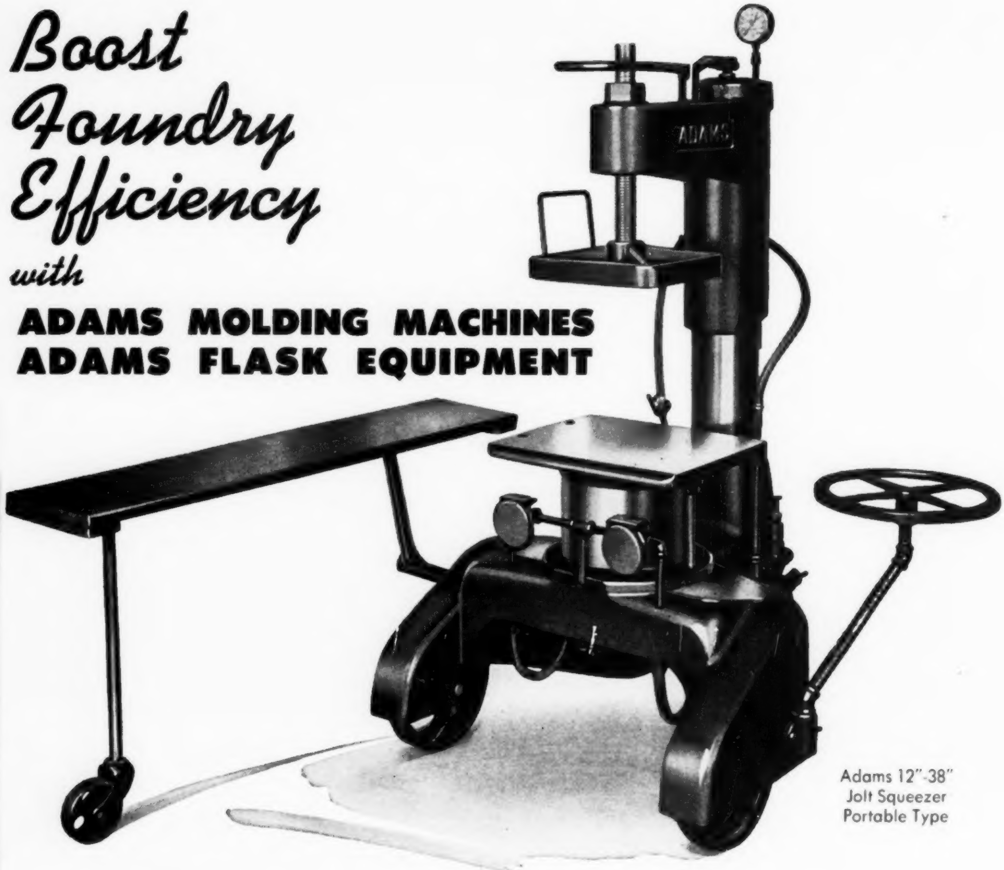
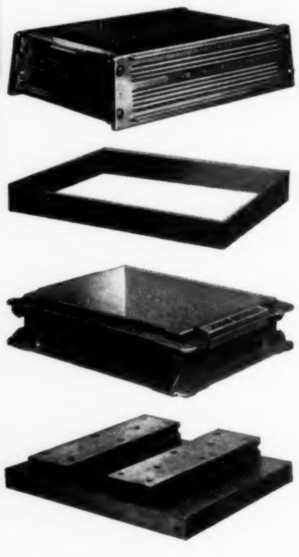
Boost Foundry Efficiency

with

ADAMS MOLDING MACHINES
ADAMS FLASK EQUIPMENT



Adams 12"-38"
Jolt Squeezer
Portable Type



SIXTY-FIVE YEARS of supplying foundries has given Adams experience and skill in designing machines and equipment that help boost efficiency in your foundry. Call on Adams for quality Flask Equipment, custom-built to your specifications. The complete line includes practically every type of flask, jacket, upset, presser board, bottom plate and band. Adams time and money saving Molding Machines are available in pneumatically operated post and side rod types, in portable and stationary models, also hand operated models.

All Adams equipment is built by master craftsmen with the finest materials available, and the most up-to-date manufacturing facilities and methods. Write today for descriptive literature.

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The Adams Company

Dubuque, Iowa, U. S. A.

1883 — SIXTY-EIGHT YEARS OF SERVICE — 1949

That extra something can make a world of difference!

With Penolyn Core Oil you get all 10 Important Features *PLUS* the Penola name . . . assurance of first class core oil quality. For high foundry efficiency you'll find it pays to specify Penolyn Core Oil.

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frequ ... of core boxes;
sharp draws.

7 WIDE TEMPERATURE BAKING RANGE— ... cores can ... time; no

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We welcome you to the Penola Booth
American Foundrymen's Society Congress
May 2nd-5th, St. Louis, Mo.

Our engineers are always ready to serve you. Write us about your core oil problem.

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PENOLA INC.

Using FERROCARBO briquettes in the charge, a large producer of duplex cupola-air furnace iron reduced scrap, due to metal defects by 42%. The reduction in scrap, due to all causes, amounted to 19.3%; while *the overall yield,* figured by dividing the total melt into the weight of good hard iron castings, *was increased by* 9.4%. These figures are based on scrap loss records compiled over a two month period and charted here. These results are particularly illuminating when it is realized that they chart defects attributed to metal composition and melting practice only.

Because FERROCARBO briquettes, used in the charge of the cupola in the malleable industry, can reduce scrap losses and produce an increase in overall yield . . . their use is worth investigating. Our metallurgical staff can furnish complete detailed information. Call them in and talk it over. There's no obligation, of course.

FERROCARBO Briquettes

BY CARBORUNDUM

TRADE MARK

THE CARBORUNDUM COMPANY, Abrasive Grain and FERROCARBO Division, Niagara Falls, New York

FERROCARBO Distributors: Kerchner, Marshall & Co., Pittsburgh, Cleveland, Birmingham, Philadelphia and Buffalo; Miller and Company, Chicago, St. Louis and Cincinnati

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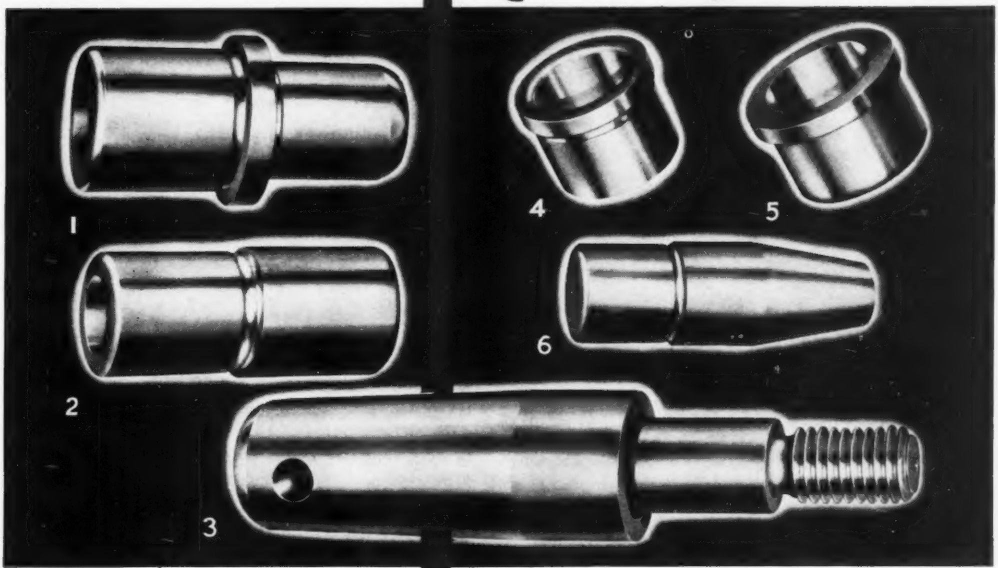
For accurate line-up of cope+drag

UNIVERSAL FLASK PINS AND BUSHINGS

Many of the cope and drag problems encountered in all foundries *are effectively solved* with the use of Universal Flask Pins and Bushings. Whether cast iron, aluminum or steel flasks are used, these modern foundry accessories *insure positive alignment, make possible new production speed.* Hardened and ground for longer life, they are available from stock in various standard sizes and shapes. Special sizes made to order. Write for complete catalog.



1. Shoulder Flask Pin
2. Plain Flask Pin
3. Plate Pin
4. Round Flask Bushing
5. Elongated Flask Bushing
6. Double Match Plate Pin

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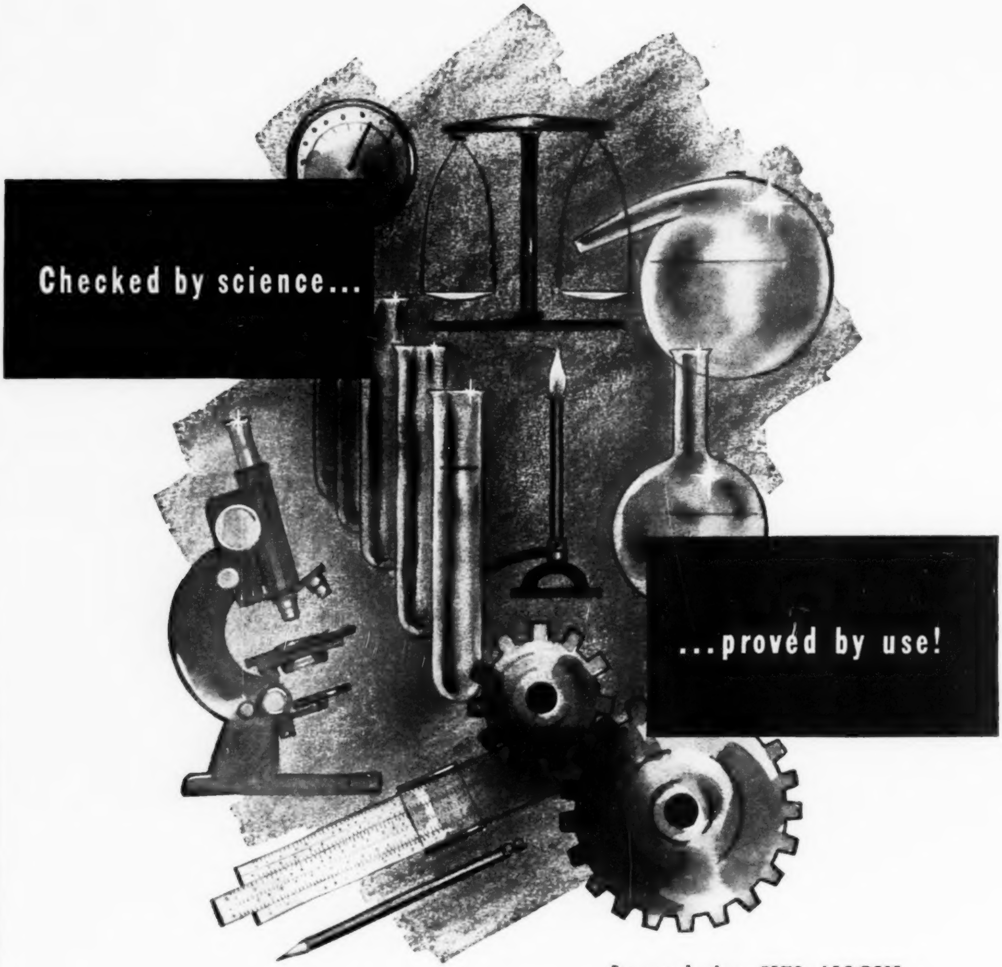

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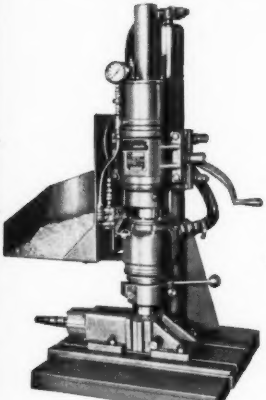

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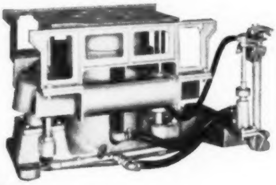

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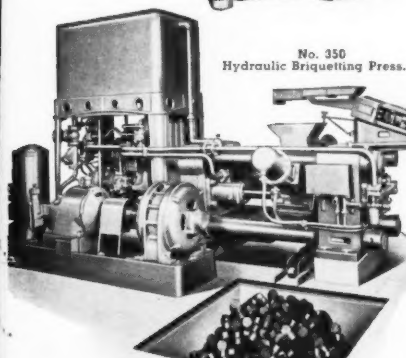

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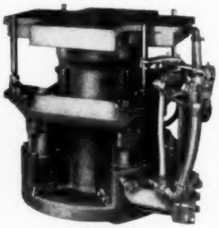

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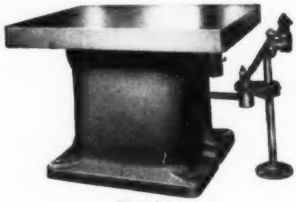

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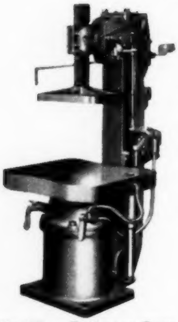
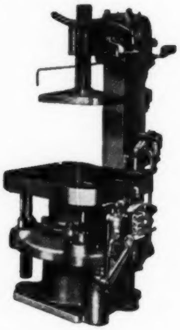


No 161 — Stationary Type
Jolt Squeezer
14" and 16" piston sizes.



No. 165
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Jolt Squeezer
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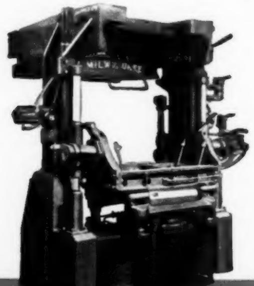

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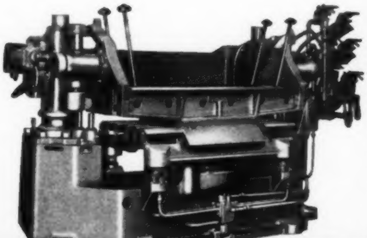

No. 403
Jolt Rollover Draw
available in 6 sizes.

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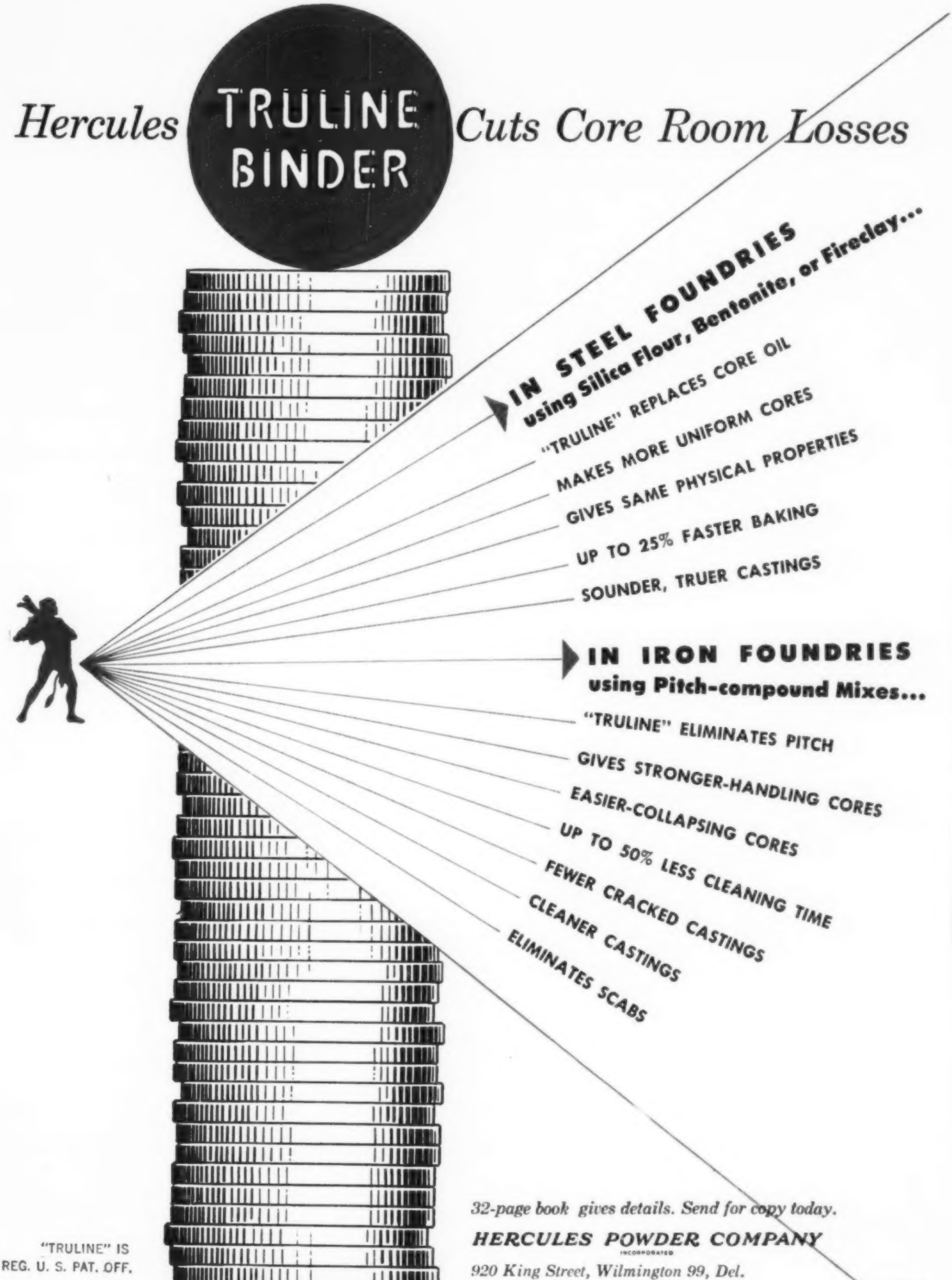
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- **LOWEST COST MIXER** of its size and type available today.
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Now you can have a rugged, low-cost, compact mixer "package" that is completely self-contained and 100% portable. *No auxiliary hoists or ceiling supports are required!* This new Simpson "Porto-Muller" is easily rolled over rough, uneven floors on its big, pneumatic implement type tires . . . right up to the sand pile for quick loading and mulling.

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SIT BACK *and* TAKE STOCK

RETURN of the demand for castings to a more normal basis affords all of us an opportunity to sit back and take stock of the foundry industry. Driven to the limit of our productive capacity for a decade, we have not had time to take care of many things that we normally would look after.

The volume of business that we have handled is far in excess of anything that we had in 1939 and 1940. Short of time, we have permitted many inefficiencies to creep into our operations. During the current return to a more normal volume of business we should check thoroughly our production processes, improving practices which deteriorated under high-pressure operation. We should look to the safety and hygiene problems in our plants and learn to know our personnel better than has been heretofore possible. We can give greater attention to the new developments that have come into the industry during the past ten years.

As the foundry industry returns to normal, increased attention is being given to the problem of new types of sands for molding and core making, oxygen as a melting aid in all types of furnaces, dielectric baking of cores, various precision casting methods, centrifugal casting in permanent molds and the study of the properties of nodular graphite cast iron.

Normal at any time in the castings industry is interest in the making of better castings more economically. To this end, valuable technical and shop information contained in AMERICAN FOUNDRYMAN, TRANSACTIONS OF A.F.S. and other Society publications is being applied more extensively.

Latest information, developing rapidly in all fields of metal casting, is that coming out of the eight A.F.S. sponsored research projects. The results of these projects are shaping up as the foundry fundamentals of the future. Reports on all eight—sand at high temperatures, heat transfer, hot tearing of steel, centrifugal casting of light metals, influence of coke heredity in cupola melting, fluid flow of metals, copper-base alloy fracture test, and selective hardening of pearlitic malleable—will be heard at the 53rd Annual A.F.S. Convention in St. Louis, May 2-5.

With more time and ideas available foundrymen for the first time since the war have the opportunity of doing a thorough job of bettering their products and their plant operations. The overall result of the period through which we are passing should give the industry a better competitive position and should afford our customers a product of far higher quality than is now available.

W. B. WALLIS, *President*
AMERICAN FOUNDRYMEN'S SOCIETY

Rounding out a year as head of the world's largest foundry technical society, A.F.S. President W. B. Wallis is touring North America with the object of visiting every Society chapter and regional foundry conference. Included on his itinerary are the A.F.S. student chapters, the 53rd Annual Convention of the Society, the 6th Annual Chapter Officers Conference (Chicago, June 27-28) and a number of meetings of other foundry organizations. Meeting with chapter boards of directors and with committee members, President Wallis has had close contact with foundry leaders and ample opportunity to study business conditions. During his term as Vice-President of A.F.S. (1947-48), he completed his most recent European trip during which he visited the British Isles, several Scandinavian countries and many parts of Western Europe.

Foundrymen are placing greater emphasis on attendance at this year's Annual A.F.S. Convention because, as business approaches a normal operating level, they have more time to study and apply recent developments. To be reported in detail at the Society's 53rd Annual Meeting in St. Louis, May 2-5, are newest foundry developments of the past year and wartime advances not previously reported. Heavy requests for preprints of Convention papers—mailing started April 1—and substantial number of hotel reservations made foretell heavy attendance and high interest in Convention proceedings.

Technical sessions, shop course meetings, roundtable luncheons and special gatherings such as the Annual Business Meeting provide information and opportunity for discussion to foundrymen in every phase of the industry. Sessions scheduled cover aluminum and magnesium, brass and bronze, malleable, education, gray iron, sand, heat transfer, time study and methods, steel, refractories, pattern, foundry costs, plant and plant equipment and safety and hygiene. Sponsored by the various technical committees and divisions of A.F.S., these meetings offer a total of 73 papers and discussion opportunities.

Varied Program Appeals to All

General interest meetings highlighting the Convention program are the Annual Business Meeting and the Annual Banquet climaxing the four-day series of sessions. Other traditional events include the Educational Dinner, the Canadian Dinner, the Engineering School Graduates Luncheon and the A.F.S. Alumni Dinner. Again this year there will be a Ladies Entertainment Program (see page 64) extending throughout Convention-week. An important adjunct to the technical sessions is the Plant Visitation Program (page 51) planned by St. Louis District Chapter members and foundries—hosts to this year's A.F.S. Convention.

At the Annual Business Meeting, scheduled for 2:00 p.m., Wednesday, May 4, President W. B. Wallis will make the Presidential Address and will present awards to the first place winners in the four divisions of the A.F.S. Apprentice Contest. Other business includes election of officers and directors for 1949-50. The [illegible] Annual Lecture—*"Steel Castings in Welded Assemblies,"* by John Howe Hall, foundry consultant—follows the Annual Business Meeting.

A.F.S. Gold Medals and Honorary Life Memberships will be presented at the Annual Banquet, 7:00 p.m., Thursday, May 5. Banquet speaker is The Honorable W. Stuart Symington, Secretary of the Air Force.

Charge Registration Fee

Admission to Convention sessions for everyone will be by badge obtainable on registration. In accordance with a decision of the A.F.S. Board of Directors, there will be a registration fee of $5.00 for Society members and $7.50 for non-members. Only meetings not requiring a fee-paid badge are the Gray Iron and Sand Shop Courses to be held the evenings of May 2, 3 and 4.

Advance registration facilities for the convenience of early Convention attendants will be provided in the Jefferson Hotel, Sunday, May 1, 1:00 p.m. to 5:00 p.m.

Special registration in the Canadian and the International Guest Books will take place at a booth near A.F.S. Convention Headquarters. Not required as is registration to participate in general Foundry Congress activities, these guest registration booths provide convenient meeting places for international visitors.

In addition to the exhibit of entries in the 1949 A.F.S. Apprentice Contest, there will be a special showing of patterns and castings entered in a local contest sponsored for St. Louis District Chapter apprentices over the age limit for the A.F.S. Contest. Now in its 26th year, the Annual A.F.S. Apprentice Contest was judged early in April and results will be announced at the Convention and in American Foundryman.

Special services at the Convention will include a publications booth where foundrymen may examine and order publications of the Society.

Two Exchange papers, traditional A.F.S. Convention features cutting across distance and international boundaries to provide friendly exchange of foundry technical information, will be presented this year.

Exchange paper from the Institute of British Foundrymen is "*The Properties of Cast Iron in Relation to the Carbon Equivalent Value.*" To be read at 4:00 p.m., Wednesday, May 4, the paper is by Dr. H. T. Angus, F. Dunn and D. Marles of the British Cast Iron Research Association. A. W. Silvester, Russell Mfg. Co. Pty. Ltd., Melbourne, Australia, will present the Institute of Australian Foundrymen exchange paper, "*Graphitization of Gray Cast Iron by Heat Treatment,*" at 10:00 a.m., Thursday, May 5.

Start Technical Program Early

The technical program of the 1949 A.F.S. Convention starts Monday, May 2, 10:00 a.m., with papers sponsored by the Aluminum and Magnesium, the Brass and Bronze and the Malleable Divisions. Leading off on the light alloys papers are A. M. Montgomery, Aluminum Company of America, Cleveland, with a paper on "*Metallography of Aluminum Castings Alloys,*" and P. F. George, Dow Chemical Co., Midland, Mich., on "*Metallography of Cast Magnesium Alloys.*"

Following this, at 12:00 noon, Monday, the Aluminum and Magnesium Round Table Luncheon will feature a progress report on the A.F.S. Aluminum and Magnesium Research Project at Battelle Memorial Institute, Columbus, Ohio, including a motion picture showing "*Fluid Flow in Transparent Molds.*"

The 10:00 a.m., Tuesday, light metals technical session has two papers, "*Designing Magnesium Castings for Aircraft Engines,*" by M. H. Young and A. G. Slachta, Wright Aeronautical Co., Wood Ridge, N. J., and "*Design of Light Metal Castings,*" G. H. Found, Dow Chemical Co., Midland, Mich.

The final session, at 2:00 p.m. Tuesday, May 3, will have three papers: "*Correlation of Cooling Curve Data With Casting Characteristics of Aluminum Alloys,*" by E. E. Stonebrook and W. E. Sicha, Aluminum Company of America, Cleveland; "*Fluxing of Aluminum Alloys,*" a committee report to be presented by H. Brown, Solar Aircraft Co., Des Moines, Ia.; and "*Grain Refining of Aluminum Alloys and Its Effect on Physical Properties,*" by W. Bonsack and O. Tichy, Apex Smelting Co.

The Malleable Division program will begin with J. E. Rehder, Canadian Bureau of Mines, Ottawa, Ontario, speaking on "*Effects of Temperature and Silicon Content on First Stage Annealing of Blackheart Malleable Iron,*" and a progress report on the Malleable Iron Research Project, "*Surface Hardening of Pearlitic Malleable Iron,*" by S. H. Bush, W. P. Wood and F. B. Rote, University of Michigan, Ann Arbor.

At 2:00 p.m., May 2, the malleable session will have addresses on "*Influence of Type of Slag on Heat Treatment Susceptibility of Malleable Iron,*" by G. Vennerholm and H. N. Bogart, Ford Motor Co., Dearborn, Mich., and "*Influence of Heating Rate on First Stage Graphitization of White Cast Iron,*" by R. Schneidewind, University of Michigan, and D. J. Reese, International Nickel Co., New York.

The 4:00 p.m. Monday malleable technical session will feature papers by R. W. Heine, University of Wisconsin, on "*Some Effects of Deoxidation Treatments on Graphitization of White Cast Iron,*" and J. E. Rehder, Canadian Bureau of Mines, on "*Influence of Silicon Content on Critical Temperature Range During Slow Cooling of Blackheart Malleable Iron.*"

Tuesday morning, May 3, will open with a 10:00 a.m. technical session on "*Controlled Atmosphere Annealing of Malleable Iron,*" by R. P. Schauss, Illinois Clay Products Co., Chicago, and "*Maintenance in a Mechanized Foundry,*" by C. T. Luther, Central Foundry Division, G.M.C., Saginaw, Mich.

The Malleable Round Table Luncheon, to be held at 12:00 noon, May 3, will feature two discussions: "*Reduction of Losses Due to Cracks or Tears,*" led by R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis., and K. H. Hamblin, The Grinnell Co., Providence, R. I., and "*Improved Malleable Melting Refractories,*" led by M. J. Henley, Texas Foundries, Inc., Lufkin, Texas, and F. Czapski, Chicago Malleable Castings Co., Chicago.

The final Malleable Division technical session will be held jointly with the Gray Iron Division at 4:00 p.m. May 3, and will be a symposium on "*Production of Nodular Graphite Gray Iron.*" Main speaker is D. J. Reese, International Nickel Co., New York, with discussion by G. Vennerholm, Ford Motor Co., Dearborn, Mich., R. G. McElwee, Vanadium Corporation of America, Detroit, and C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

Beginning on Monday morning, the Brass and Bronze Division will open its program with a technical session at 10:00 a.m., featuring three addresses: "*Casting Finish,*" H. H. Fairfield and J. MacConachie, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.; "*Effects of Melting Atmosphere, Time at Temperature and Degasification on Properties of Valve Bronze,*" W. H. Baer and B. M. Loring, Naval Research Laboratory, Washington, D. C.; and "*Practical Melting and Its Relation to Gases in Metal,*" O. E. Decker, Acheson Manufacturing Co., Pittsburgh.

At 2:00 p.m., Monday, the Brass and Bronze Division offers "*Gas Fired Melting of Copper-Base Alloys in a Reducing Atmosphere,*" D. C. Caudron, Pacific Brass Foundry, San Francisco, and "*The Problem of Gases in the Indirect Arc Furnace,*" M. G. Dietl, Crane Co., Chicago. At 4:00 p.m. brass and bronze foundrymen will hear B. N. Ames and N. A. Kahn, New York Naval Shipyard, Brooklyn, N. Y., speak on "*Graphite Resistor Furnace Melting Practice,*" and a progress

Aerial view of downtown St. Louis, host city to this year's A.F.S. Convention. The Mississippi is in background.

report on the Brass and Bronze Research Project *"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass,"* by J. P. Ewing, C. Upthegrove, and F. B. Rote, University of Michigan, Ann Arbor.

Tuesday's 10:00 a.m. brass and bronze session will cover *"Effect of Composition on Properties and Structure of Cast Monel,"* by J. T. Eash and T. E. Kihlgren, International Nickel Co., Bayonne, N. J., and *"Recent Developments in Theory and Practice of Insulating Sleeves, Pads and Risers for Non-Ferrous Casting,"* by K. A. Miericke, U. S. Gypsum Co., Chicago.

Immediately following, the Brass and Bronze Round Table Luncheon at 12:00 noon Tuesday, will be devoted to a discussion on *"Some Practical Applications of the Fundamental Principles of Melting, Pouring and Casting of Tin Bronzes,"* with the following discussion leaders: *Melting,* H. M. St. John, Crane Co., Chicago; *Pouring,* L. W. Eastwood, Battelle Memorial Institute; *Gates and Risers,* G. Bradshaw, Philadelphia Naval Shipyard, Philadelphia.

The program of the Gray Iron Division will begin at 8:00 p.m. Monday night, May 2, with the first of three Gray Iron Shop Courses, at which W. W. Levi, Lynchburg Foundry Co., Radford, Va., will speak on *"Carbon Trends in Gray Iron."*

The following afternoon, May 3, at 4:00 p.m. the Gray Iron and Malleable Divisions will hold a joint symposium on *"Production of Nodular Graphite Gray Iron."* At the Tuesday evening Gray Iron Shop Course, a discussion on *"Inexpensive Tests for Small Gray Iron Foundries"* will be led by W. Bohm, Buick Motor Division, General Motors Corp., Flint, Mich.

Will Report Cupola Research Progress

Wednesday's gray iron program will begin with a paper, *"Effect of Boron on Structure and Some Properties of Plain Cast Irons,"* by A. I. Krynitsky and H. Stern, National Bureau of Standards, Washington, D. C. D. E. Krause, Gray Iron Research Institute, Inc., and H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio, will present *"Blast Humidity as a Factor in Cupola Operations."*

At 4:00 p.m., S. C. Massari, American Foundrymen's Society, Chicago, will present a paper, *"Graphitizing Behavior of White Cast Iron."* At the same session there will be a progress report on the Cupola Research Project by R. G. McElwee, Vanadium Corporation of America, Detroit, and the exchange paper from the Institute of British Foundrymen—*"The Properties of Cast Iron in Relation to the Carbon Equivalent Value"*—by Dr. H. T. Angus, F. Dunn and D. Marles of the British Cast Iron Research Association.

Beautiful Milles Fountain greets travelers and visitors as they step onto the street from the Union Station.

A joint session of the Gray Iron and Steel Divisions, Wednesday, 8:00 p.m., will feature two colored motion pictures, *"Finger Gating"* and *"Step Gating"* by W. H. Johnson and W. O. Baker, Naval Research Laboratory, Washington, D. C. Held simultaneously will be the third and last Gray Iron Shop Course meeting with a panel discussion on *"Sources of Metal Losses in the Foundry."* Panel members are A. Barczak, Superior Foundry Co., Cleveland, and N. L. Peukert, Carondelet Foundry Co., St. Louis.

The Thursday, May 5, gray iron program will begin with a 10:00 a.m. session including two papers: *"High Silicon Cast Iron Resists Growth and Scaling,"* by W. H. White, Jackson Iron & Steel Co., Jackson, Ohio, and A. R. Elsea, Battelle Memorial Institute, Columbus, Ohio; and *"Graphitization of Gray Cast Iron by Heat Treatment,"* Institute of Australian Foundrymen exchange paper, by A. W. Silvester, Russell Mfg. Co. Pty, Ltd., Melbourne, Australia.

Held for the first time this year will be the Gray Iron Round Table Luncheon, set for noon, May 5. H. F. Taylor, Massachusetts Institute of Technology, and N. A. Birch, American Brake Shoe Co., Mahwah, N. J., will lead a discussion on *"Gating and Risering."* Concluding gray iron session features *"Production and Consumption of Heat in the Cupola,"* by D. W. Gunther, National Radiator Co., Johnstown, Pa., and *"Design and Operation of a 10-inch Cupola,"* by D. E. Krause, Gray Iron Research Institute, Inc., and H. W. Lownie, Jr., Battelle Memorial Institute, Columbus.

Three Sand Shop Course sessions, to be held the evenings of May 2, 3, 4 and two sand technical sessions, scheduled for May 3 and 4, comprise the Sand Division's program. The first Sand Shop Course meeting will be held Monday at 8:00 p.m. on *"Causes of Penetration in Steel Castings,"* with E. E. Woodliff, Foundry

Municipal Bridge crosses the Mississippi River to form one of the links between St. Louis and Illinois.

Sand Service Engineering Co., Detroit, as the leader.

Second Sand Shop Course session, to be held at 8:00 p.m., May 3, will have as its subject *"Resin Sand Cores vs. Oil Sand Cores,"* with T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va., leading the discussion.

The third and final Sand Shop Course meeting will be held at 8:00 p.m., Wednesday, May 4, and will deal with *"Core Sand Blowing Practice."* H. Schutzenhoffer, The Key Co., East St. Louis, Ill., will lead discussion.

Three papers are included on the 2:00 p.m., Tuesday sand session. They are: *"Plastic Binders for Foundry Sand Practice,"* by H. K. Salzberg, The Borden Co., Bainbridge, N. Y.; *"Elevated Temperature Properties of Steel Molding Sands,"* progress report on the Sand Research Project, P. E. Kyle, Cornell University, Ithaca, N. Y.; and *"Causes of Rat-Tail Defects,"* committee report by Harry W. Dietert, Harry W. Dietert Co., Detroit.

Wednesday's sand session at 10:00 a.m. has two papers, *"pH of Foundry Sands,"* Bradley H. Booth, Carpenter Bros., Inc., Milwaukee, and *"Causes of Scab Defect,"* committee report, by George F. Watson, American Brake Shoe Co., Mahwah, N. J.

Beginning at 10:00 a.m., Wednesday, the program of the Steel Division will open with a technical session featuring three addresses: *"A New Method for Determining Austenitic Grain Size of Cast Steel,"* by E. J. Eckel, University of Illinois, and S. J. Paprocki, Battelle Memorial Institute, Columbus; *"Note on As-Cast Structure and Grain Size in Cast Alloy Steels,"* by E. A. Loria, Mellon Institute of Industrial Research, Pittsburgh; and *"Prevention of Hot Tears in Thick-Walled Centrifugally Cast Steel Tubes,"* by J. F. Wallace and J. L. Martin, Watertown Arsenal, Watertown, Mass.

Hold Joint Steel-Gray Iron Meeting

At 8:00 p.m., Wednesday, May 4, the Steel Division and Gray Iron Division will hold a joint session at which W. H. Johnson and W. O. Baker of the Naval Research Laboratory, Washington, D. C., will present films on *"Finger Gating"* and *"Step Gating."*

The Thursday morning, May 5, steel technical session at 10:00 a.m. will feature two addresses: *"Rapid Analysis of Acid Slags,"* by E. C. Zuppann, Wilson Foundry & Machine Co., Pontiac, Mich., and A. E. Martin, University of Minnesota, and *"A Study of Insulating and Mildly Exothermic Antipiping Compounds Used for Steel Castings,"* by S. L. Gertsman, Canadian Bureau of Mines, Ottawa, Ont.

The Steel Round Table Luncheon, to be held at 12:00 noon, will have as its subject *"Sand Testing and Its Relation to Casting Defects."* At 4:00 p.m. C. E. Sims, H. A. Saller and F. W. Boulger, all of Battelle Memorial Institute, will present *"Effect of Various Deoxidizers on the Structure of Sulphide Inclusions,"* with J. F. Wallace, Watertown Arsenal, speaking on *"Effect of Aluminum and Vanadium on the Toughness of High-Hardenability Cast Steel."*

Educational Division activities at the 53rd Annual A.F.S. Convention include the Educational Dinner, 6:30 p.m., Monday, May 2, and the Engineering School Graduates Luncheon, Wednesday noon. At the dinner, there will be a discussion of *"How to Interest Our Youth in the Foundry Industry,"* with E. E. Green, Indianapolis Public Schools, Indianapolis, representing the educators and F. B. Skeates, Link-Belt Co., Chicago, representing industry.

A technical session and a round table luncheon are sponsored by the Pattern Division this year. At the 2:00 p.m., May 3, pattern session, R. G. Christensen, Racine Pattern Works, Racine, Wis., will talk on *"Information Needed to Produce Satisfactory Pattern Equipment,"* and Albert Huebner, Allis-Chalmers Mfg. Co., Milwaukee, will discuss *"Maintenance of Wood and Metal Patterns."* Discussion topic at the Pattern Round Table Luncheon, Wednesday noon, is *"Shall Pattern Equipment Be Machined or Cast to Size?"* Discussion leader will be Vaughan C. Reid, Jr., City Pattern Foundry & Machine Co., Detroit.

The Heat Transfer Committee's technical session will be held at 10:00 a.m., Tuesday, May 3, and will consist of a progress report on Heat Transfer Research on *"Comparative Solidification Studies"* at Columbia University given by V. Paschkis of Columbia University. Dr. Paschkis will also present a paper on *"The Foundryman and Heat Transfer"* at the same session.

The Time Study and Methods technical session will take place at 4:00 p.m., Tuesday, May 3, and will be on *"Developing Standard Data Tables for a Four-Man Molding Unit,"* by M. T. Sell, Sterling Foundry Co.

The Foundry Cost Session at 4:00 p.m., May 3, will feature *"Approach to Standard Costs in the Foundry,"* by F. Ruffalo, Westover Engineers, Milwaukee; and a question and answer period on cost problems of general interest, cost accounting methods, distribution, etc.

"Your Refractory Problems—What Are They?" is the topic of the refractories panel discussion scheduled for 4:00 p.m., May 3.

The Plant and Plant Equipment technical session will be held at 8:00 p.m., Tuesday evening, May 3, and will be on *"Modern Foundry Core and Mold Ovens,"* by C. A. Barnett, Foundry Equipment Co., Cleveland.

A feature of earlier A.F.S. Conventions revived this year, will be a Safety & Hygiene technical session, at which H. J. Weber, American Brake Shoe Co., Chicago, and George E. Tubich, Michigan Department of Health, Grand Rapids, will speak. Mr. Tubich will speak first on *"Attracting and Keeping Good Men in the Foundry."* Mr. Weber will talk on *"Industrial Hygiene in the Foundry."*

One of the finest, the St. Louis zoo is located in Forest Park, second largest public park in America.

Program Personalities


C. E. Nelson


G. P. Phillips


W. H. Baer


W. Romanoff


J. E. Rehder


A. W. Stolzenburg


C. F. Joseph


R. W. Parsons


W. O. Baker

MONDAY, MAY 2

8:30 AM — Registration Begins
10:00 AM (A) — Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—A. W. Stolzenburg, Aluminum Company of America, Detroit.

Co-Chairman—T. E. Kramer, Acme Aluminum Alloys, Inc., Dayton, Ohio.

"*Metallography of Aluminum Casting Alloys*"—A. M. Montgomery, Aluminum Company of America.

"*Metallography of Cast Magnesium Alloys*"—P. F. George, Dow Chemical Company, Midland, Mich.

10:00 AM (B) — Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—E. W. Horlebein, Gibson & Kirk Co., Baltimore.

Co-Chairman—R. W. Parsons, Ohio Brass Co., Mansfield, Ohio.

"*Casting Finish*"—H. H. Fairfield and J. MacConachie, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.

"*Effects of Melting Atmosphere, Time at Temperature and Degasification on Properties of Valve Bronze*"—W. H. Baer and B. M. Loring, Naval Research Laboratories, Washington, D. C.

"*Practical Melting and Its Relation to Gases in Metal*"—O. E. Decker, Acheson Manufacturing Co.


G. Vennerholm


N. A. Kahn


W. A. Pennington


H. Stern


H. H. Fairfield


H. W. Lownie


E. Berry

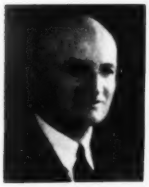

A. I. Krynitsky


H. W. Dietert


W. D. McMillan


D. W. Gunther


D. E. Krause


H. Bornstein


J. R. Allan


V. A. Crosby


F. S. Brewster


A. W. Gregg


L. C. Wilson

MONDAY, MAY 2 *(Cont.)*

10:00 AM (C) — Malleable Session

(Sponsored by Malleable Division)

Presiding—J. A. Durr, Albion Malleable Iron Co., Albion, Mich.

Co-Chairman—H. L. Day, Auto Specialties Mfg. Co., St. Joseph, Mich.

"*Effects of Temperature and Silicon Content on First Stage Annealing of Blackheart Malleable Iron*"—J. E. Rehder, Canadian Bureau of Mines, Ottawa.

"*Surface Hardening of Pearlitic Malleable Iron*"—Progress Report, Malleable Research Project—S. H. Bush, W. P. Wood and F. B. Rote, University of Michigan, Ann Arbor.

12:00 Noon — Aluminum and Magnesium Round Table Luncheon

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. F. Thomson, International Nickel Co., Detroit.

Co-Chairman—W. E. Sicha, Aluminum Company of America, Cleveland.

"*Fluid Flow in Transparent Molds*"—Progress Report and Motion Picture, Aluminum and Magnesium Research Project—R. E. Swift, J. H. Jackson and L. W. Eastwood, Battelle Memorial Institute, Columbus, Ohio.

2:00 PM (A) — Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—H. J. Roast (Retired—Canadian Bronze Co., Ltd.) Montreal.

Co-Chairman—W. Romanoff, H. Kramer & Co., Chicago.

"*Gas Fired Melting of Copper Base Alloys in a Reducing Atmosphere*"—D. C. Caudron, Pacific Brass Foundry, San Francisco.

"*The Problem of Gases in the Indirect Arc Furnace*"—M. G. Dietl, Crane Co., Chicago.

2:00 PM (B) — Malleable Session

(Sponsored by Malleable Division)

Presiding—W. D. McMillan, International Harvester Co., Chicago.

Co-Chairman—R. P. Schauss, Illinois Clay Products Co., Chicago.

"*Influence of Type of Slag on Heat Treatment Susceptibility of Malleable Iron*"—G. A. Vennerholm and H. N. Bogart, Ford Motor Co., Dearborn, Mich.

"*Influence of Heating Rate on First Stage Graphitization of White Cast Iron*"—R. Schneidewind, University of Michigan, Ann Arbor, and D. J. Reese, International Nickel Co., New York.

4:00 PM (A) — Malleable Session

(Sponsored by Malleable Division)

Presiding—C. F. Joseph, Central Foundry Division, G.M.C., Saginaw, Mich.

AFS 53rd Program


L. F. Tucker


R. P. Schauss


H. K. Swanson


E. E. Woodliff


R. H. Zoller


R. L. Lee


K. H. Priestley


A. F. Pfeiffer


C. Locke


K. A. Mierické


E. C. Zuppann


T. E. Eagan

MONDAY, MAY 2 (Cont.)

Co-Chairman—C. F. Lauenstein, Link-Belt Co., Indianapolis.

"*Some Effects of Deoxidation Treatments on Graphitization of White Cast Iron*"—R. W. Heine, University of Wisconsin, Madison.

"*Influence of Silicon Content on Critical Temperature Range During Slow Cooling of Blackheart Malleable Iron*"—J. E. Rehder, Canadian Bureau of Mines.

4:00 PM (B) — Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—H. M. St. John, Crane Co., Chicago.

Co-Chairman—B. M. Loring, Naval Research Laboratories, Washington, D. C.

"*Graphite Resistor Furnace Melting Practice*"—B. N. Ames and N. A. Kahn, New York Naval Shipyard.

"*Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass*"—Brass and Bronze Research Progress Report—J. P. Ewing, C. Upthegrove, and F. B. Rote, University of Michigan, Ann Arbor.

5:00 PM — Registration Closes
6:30 PM — Educational Dinner

(Sponsored by Educational Division)

Presiding—F. G. Sefing, International Nickel Co.

Co-Chairman—A. W. Gregg, Whiting Corporation, Harvey, Ill.

"*How to Interest Our Youth in The Foundry Industry*"—Discussion by E. E. Greene, Indianapolis Public Schools, and F. B. Skeates, Link-Belt Co., Chicago.

8:00 PM (A) — Gray Iron Shop Course

(Sponsored by Gray Iron Shop Course Committee)

Presiding—K. H. Priestley, Vassar Electroloy Products, Inc., Vassar, Mich.

Co-Chairman—N. L. Peukert, Carondelet Foundry Co., St. Louis.

Subject—"*Carbon Trends in Gray Iron.*"

Discussion Leader—W. W. Levi, Lynchburg Foundry Co., Radford, Va.

8:00 PM (B) — Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—R. H. Jacoby, The Key Company, East St. Louis, Ill.

Co-Chairman—L. A. Kleber, General Steel Castings Co., Granite City, Ill.

Subject—"*Causes of Penetration in Steel Castings.*"

Discussion Leader—E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit.

TUESDAY, MAY 3

9:00 AM — Registration Opens
10:00 AM (A) — Heat Transfer Session

(Sponsored by Heat Transfer Committee)

Presiding—E. C. Troy, Palmyra, New Jersey.

H. F. Taylor

W. H. Johnson

W. E. Sicha

V. Paschkis

B. M. Loring

T. W. Curry

H. Brown

R. H. Frank

M. E. Annich

D. F. Sawtelle

C. O. Burgess

A. M. Fulton

E. L. Thomas

V. E. Zang

A. R. Elsea

H. L. Smith

P. E. Rentschler

C. H. Lorig

TUESDAY, MAY 3 (Cont.)

Co-Chairman—J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio.

"*Comparative Solidification Studies*"—Progress Report, Heat Transfer Research, V. Paschkis, Columbia University, New York.

"*The Foundryman and Heat Transfer*"—V. Paschkis, Columbia University, New York.

10:00 AM (B) — Malleable Session

(Sponsored by Malleable Division)

Presiding—M. Tilley, National Malleable & Steel Castings Co., Cleveland.

Co-Chairman—E. Welander, Union Malleable Iron Works, Deere & Co., East Moline, Ill.

"*Controlled Atmosphere Annealing of Malleable Iron*"—Committee Report, R. P. Schauss, Illinois Clay Products Co., Chicago.

"*Maintenance in a Mechanized Foundry*"—C. T. Luther, Central Foundry Division, G.M.C., Saginaw Malleable Foundry, Saginaw, Mich.

10:00 AM (C) — Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—C. E. Nelson, Dow Chemical Co., Midland, Mich.

Co-Chairman—W. T. Bean, Jr., Consultant, Detroit.

"*Designing Magnesium Castings for Aircraft Engines*"—M. H. Young and A. G. Slachta, Wright Aeronautical Co., Wood Ridge, N. J.

"*Design of Light Metal Castings*"—G. H. Found, Dow Chemical Co., Midland, Mich.

10:00 AM (D) — Brass and Bronze Session

(Sponsored by Brass and Bronze Division)

Presiding—A. K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee.

Co-Chairman—H. F. Taylor, Massachusetts Institute of Technology, Cambridge.

"*Effect of Composition on Properties and Structure of Cast Monel*"—J. T. Eash and T. E. Kihlgren, International Nickel Co., Bayonne, N. J.

"*Recent Developments in Theory and Practice of Insulating Sleeves, Pads, and Risers for Non-Ferrous Casting*"—K. A. Miericke, U. S. Gypsum Co., Chicago.

12:00 Noon (A) — Brass and Bronze Round Table Luncheon

(Sponsored by Brass and Bronze Division)

Presiding—B. A. Miller, The Baldwin Locomotive Works, Philadelphia.

Co-Chairman—H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh.

Subject—"*Some Practical Applications of the Fundamental Principles of Melting, Pouring and Casting of Tin Bronzes.*"

Discussion Leaders—Melting—H. M. St. John, Crane Co., Chicago. Pouring—L. W. Eastwood, Battelle

53rd.

Program

TUESDAY, MAY 3 *(Cont.)*

Memorial Institute, Columbus, Ohio. Gates & Risers —G. Bradshaw, Philadelphia Naval Shipyard, Philadelphia.

12:00 Noon (B) — Malleable Round Table Luncheon

(Sponsored by Malleable Division)

Presiding—J. H. Lansing, Malleable Founders' Society, Cleveland.

Co-Chairman—A. M. Fulton, Northern Malleable Iron Co., St. Paul, Minn.

Subject—"*Reduction of Losses Due to Cracks or Tears.*"

Discussion Leaders—R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis., and K. H. Hamblin, Grinnell Co., Providence, R. I.

Subject—"*Improved Malleable Melting Refractories*"

Discussion Leaders—M. J. Henley, Texas Foundries, Inc., Lufkin, and F. Czapski, Chicago Malleable Castings Co., Chicago.

2:00 PM (A) — Sand Session

(Sponsored by Sand Division)

Presiding—C. B. Jenni, General Steel Castings Corp., Eddystone, Pa.

Co-Chairman—T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

"*Plastic Binders for Foundry Sand Practice*"—H. K. Salzberg, The Borden Co., Chemical Division, Bainbridge, N. Y.

"*Elevated Temperature Properties of Steel Molding Sands*"—Progress Report, Research Project—P. E. Kyle, Cornell University, Ithaca, N. Y.

"*Causes of Rat-Tail Defects*"—Committee Report, H. W. Dietert, Harry W. Dietert Co., Detroit.

2:00 PM (B) — Aluminum and Magnesium Session

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. A. Quadt, Federated Metals Div., American Smelting & Refining Co., Perth Amboy, N. J.

Co-Chairman—A. J. Juroff, Bendix Aviation Corp., Eclipse-Pioneer Div., South Bend, Indiana.

"*Correlation of Cooling Curve Data with Casting Characteristics of Aluminum Alloys*"—E. E. Stonebrook and W. E. Sicha, Aluminum Company of America, Cleveland.

"*Fluxing of Aluminum Alloys*"—Committee Report, H. Brown, Solar Aircraft Company, Des Moines.

"*Grain Refining of Aluminum Alloys and Its Effect on Physical Properties*"—W. Bonsack and O. Tichy, Apex Smelting Co., Cleveland.

2:00 PM (C) — Pattern Session

(Sponsored by Pattern Division)

Presiding—A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.

Co-Chairman—H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Indiana.

"*Information Needed to Produce Satisfactory Pattern Equipment*"—R. G. Christensen, Racine Pattern Works, Racine, Wis.

"*Maintenance of Wood and Metal Patterns*"—A. Huebner, Allis-Chalmers Mfg. Co., Milwaukee.

4:00 PM (A) — Foundry Cost Session

(Sponsored by Cost Committee)

Presiding—R. L. Lee, Grede Foundries, Inc., Milwaukee.

Co-Chairman—G. Tisdale, Zenith Foundry Co., Milwaukee.

"*Approach to Standard Costs in the Foundry*"—F. Ruffalo, Westover Engineers, Milwaukee.

Question and Answer Period—Cost Problems of General Interest, Method of Cost Accounting, Distribution of Costs, etc.

4:00 PM (B) — Refractories Session

(Sponsored by Refractories Committee)

Presiding—R. H. Zoller, Zoller Casting Co., Bettsville, Ohio.

Co-Chairman—R. P. Schauss, Illinois Clay Products Co., Chicago.

Panel Discussion—"*Your Refractory Problems—What are They?*"

4:00 PM (C) — Joint Session, Gray Iron and Malleable

(Sponsored by Gray Iron and Malleable Divisions)

Presiding—H. Bornstein, Deere & Co., Moline, Illinois

Co-Chairman—C. O. Burgess, Gray Iron Founders' Society, Cleveland.

Symposium—"*Production of Nodular Graphite Gray Iron.*"

"*Spheroidal Carbon Cast Iron*"—D. J. Reese, International Nickel Co., New York.

Discussion by—G. A. Vennerholm, Ford Motor Co., Dearborn, Mich.; R. G. McElwee, Vanadium Corp. of America, Detroit; C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

R. J. Anderson

J. A. Durr

L. A. Kleber

E. A. Loria

E. Welander

D. J. Reese

G. J. Barker

W. W. Levi

M. Tilley

H. H. Wilder

B. H. Booth

B. A. Miller

R. H. Jacoby

G. W. Johnson

H. J. Roast

T. E. Kihlgren

H. M. St. John

R. W. Schroeder

4:00 PM (D) — Time Study and Methods

(Sponsored by Time Study and Methods Committee)

Presiding—E. G. Tetzlaff, Pelton Steel Casting Co., Milwaukee.

Co-Chairman—M. E. Annich, American Brake Shoe Co., Mahwah, N. J.

"*Developing Standard Data Tables for a Four-Man Molding Unit*"—M. T. Sell, Sterling Foundry Co., Wellington, Ohio.

7:00 PM — Canadian Dinner

8:00 PM (A) — Plant and Plant Equipment

(Sponsored by Plant and Plant Equipment Committee)

Presiding—J. Thomson, Continental Foundry & Machine Co., East Chicago, Ind.

Co-Chairman—E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

"*Modern Foundry Core and Mold Ovens*"—C. A. Barnett, The Foundry Equipment Co., Cleveland.

8:00 PM (B) — Gray Iron Shop Course

(Sponsored by Gray Iron Shop Course Committee)

Presiding—H. H. Wilder, Eaton Mfg. Co., Vassar, Mich.

Co-Chairman—M. Reichert, Banner Iron Works, St. Louis.

Subject—"*Inexpensive Tests for Small Gray Iron Foundries.*"

Discussion Leader—W. Bohm, Buick Motor Division, G.M.C., Flint, Mich.

8:00 PM (C) — Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—E. L. Thomas, Cadillac Motor Car Div., G.M.C., Detroit.

Co-Chairman—D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.

Subject—"*Resin Sand Cores vs. Oil Sand Cores.*"

Discussion Leader—T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

WEDNESDAY, MAY 4

10:00 AM (A) — Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—R. G. McElwee, Vanadium Corporation of America, Detroit.

"*Effect of Boron on Structure and Some Properties of Plain Cast Irons*"—A. I. Krynitsky and H. Stern, National Bureau of Standards, Washington, D. C.

"*Blast Humidity as a Factor in Cupola Operations*"—D. E. Krause, Gray Iron Research Institute, Inc., and H. W. Lownie, Jr., Battelle Memorial Institute.

10:00 AM (B) — Sand Session

(Sponsored by Sand Division)

Presiding—G. J. Barker, University of Wisconsin.

Program

WEDNESDAY, MAY 4 (Cont.)

Co-Chairman—H. K. Salzberg, The Borden Co., Bainbridge, N. Y.

"pH of Foundry Sands"—B. H. Booth, Carpenter Bros., Inc., Milwaukee.

"Causes of Scab Defect"—Committee Progress Report—G. F. Watson, American Brake Shoe Co., Mahwah, N. J.

10:00 AM (C) — Steel Session

(Sponsored by Steel Division)

Presiding—C. Locke, Armour Research Foundation, Chicago.

Co-Chairman—C. H. Lorig, Battelle Memorial Institute, Columbus, Ohio.

"A New Method for Determining Austenitic Grain Size of Cast Steel"—E. J. Eckel, University of Illinois, Urbana, and S. J. Paprocki, Battelle Memorial Institute, Columbus, Ohio.

"Note on As-Cast Structure and Grain Size in Cast Alloy Steels"—E. A. Loria, Mellon Institute of Industrial Research, Pittsburgh.

"Prevention of Hot Tears in Thick-Walled Centrifugally Cast Steel Tubes"—J. F. Wallace and J. L. Martin, Watertown Arsenal, Watertown, Mass.

12:00 Noon (A) — Pattern Round Table Luncheon

(Sponsored by Pattern Division)

Presiding—L. F. Tucker, City Pattern & Foundry Co., Inc., South Bend.

Co-Chairman—H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind.

"Shall Pattern Equipment be Machined or Cast to Size?"—V. C. Reid, Jr., City Pattern, Foundry & Machine Co., Detroit.

12:00 Noon (B) — Engineering School Graduates Luncheon

(Sponsored by Educational Division)

Presiding—C. J. Freund, University of Detroit.

2:00 PM — Annual Business Meeting

Presiding—W. B. Wallis, President, American Foundrymen's Society.

President's Annual Address. Apprentice Contest Awards. Election of Officers and Directors.

2:45 PM — Charles Edgar Hoyt Annual Lecture

"Steel Castings in Welded Assemblies"—John Howe Hall, Consultant, Swarthmore, Pa.

4:00 PM — Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—T. E. Eagan, Cooper-Bessemer Corp.

Co-Chairman—R. Schneidewind, University of Michigan, Ann Arbor

"Graphitizing Behavior of White Cast Iron"—S. C. Massari, American Foundrymen's Society, Chicago.

Progress Report, Cupola Research—R. G. McElwee, Vanadium Corporation of America, Detroit.

"The Properties of Cast Iron in Relation to the Carbon Equivalent Value"—Institute of British Foundrymen


B. N. Ames


C. A. Robeck


E. C. Troy


O. Tichy


C. E. Sims


R. G. McElwee


F. G. Sefing


J. Thomson


L. W. Eastwood


S. C. Massari


P. E. Kyle


C. R. Culling

J. B. Caine

A. K. Higgins

C. T. Luther

M. H. Young

A. D. Barczak

F. O. Lemmon

J. T. Eash

E. G. Tetzlaff

F. B. Skeates

M. T. Sell

C. K. Donoho

W. Bonsack

WEDNESDAY, MAY 4 (*Cont.*)

Exchange Paper—H. T. Angus, F. Dunn and D. Marles, British Cast Iron Research Association.

5:30 PM — Registration Closes
7:00 PM — A.F.S. Alumni Dinner

Missouri Athletic Club (by invitation only)

8:00 PM (A) — Gray Iron Shop Course

(Sponsored by Gray Iron Shop Course Committee)

Presiding—E. J. Burke, Hanna Furnace Corporation, Buffalo, N. Y.

Co-Chairman—R. Hill, East St. Louis Castings Co., East St. Louis, Ill.

Subject—"*Sources of Metal Losses in the Foundry.*"

Panel Discussion—A. Barczak, Superior Foundry Co., Cleveland, and N. L. Peukert, Carondelet Foundry Co., St. Louis.

8:00 PM (B) — Sand Shop Course

(Sponsored by Sand Shop Course Committee)

Presiding—F. S. Brewster, Harry W. Dietert Co., Detroit.

Co-Chairman—E. J. Bush, Naval Gun Factory, Washington, D. C.

Subject—"*Core Sand Blowing Practices.*"

Discussion Leader—H. Schutzenhoffer, The Key Company, East St. Louis, Ill.

8:00 PM (C) — Joint Session, Gray Iron and Steel

(Sponsored by Gray Iron and Steel Divisions)

Presiding—H. F. Taylor, Massachusetts Institute of Technology, Cambridge

Co-Chairman—T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

Colored Motion Pictures—"*Finger Gating*" and "*Step Gating*"—W. H. Johnson and W. O. Baker, Naval Research Laboratories, Washington, D. C.

THURSDAY, MAY 5

9:00 AM — Registration Opens
10:00 AM (A) — Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—J. S. Vanick, International Nickel Co., New York.

Co-Chairman—G. P. Phillips, International Harvester Co., Chicago.

"*High Silicon Cast Iron Resists Growth and Scaling*"—W. H. White, Jackson Iron & Steel Co., Jackson, Ohio, and A. R. Elsea, Battelle Memorial Institute, Columbus, Ohio.

"*Graphitization of Gray Cast Iron by Heat Treatment*"—Institute of Australian Foundrymen Exchange Paper—A. W. Silvester, Russell Mfg. Co. Pty., Ltd., Melbourne, Australia.

10:00 AM (B) — Steel Session

(Sponsored by Steel Division)

Presiding—E. Berry, Dodge Steel Company, Philadelphia.

Co-Chairman—C. Wyman, Burnside Steel Foundry Co., Chicago.

"*Rapid Analysis of Acid Slags*"—E. C. Zuppann, Wilson Foundry & Machine Co., Pontiac, Mich., and A. E. Martin, University of Minnesota, Minneapolis.

"*A Study of Insulating and Mildly Exothermic Antipiping Compounds Used for Steel Castings*"—S. L. Gertsman, Canadian Bureau of Mines, Ottawa.

10:00 AM (C) — Safety and Hygiene Session

(Sponsored by Safety and Hygiene Committee)

Presiding—L. C. Wilson, Reading, Pa.

Co-Chairman—J. R. Allan, International Harvester Co., Chicago.

"*Attracting and Keeping Good Men in the Foundry*"—G. E. Tubich, Michigan Department of Health, Grand Rapids.

Program

THURSDAY, MAY 5 (Cont.)

"Industrial Hygiene in the Foundry"—H. J. Weber, American Brake Shoe Co., Chicago.

12:00 Noon (A) — Gray Iron Round Table Luncheon

(Sponsored by Gray Iron Division)

Presiding—V. A. Crosby, Climax-Molybdenum Co., Detroit.

Co-Chairman—C. O. Burgess, Gray Iron Founders' Society, Cleveland.

Subject—*"Gating and Risering."*

Discussion Leaders—H. F. Taylor, Massachusetts Institute of Technology, Cambridge, and N. A. Birch, American Brake Shoe Co., Mahwah, N. J.

12:00 Noon (B) — Steel Round Table Luncheon

(Sponsored by Steel Division)

Presiding—R. H. Frank, Bonney-Floyd Co., Columbus, Ohio.

Co-Chairmen—V. E. Zang, Unitcast Corporation, Toledo, Ohio, and F. O. Lemmon, Ohio Steel Foundry Co., Springfield, Ohio.

Subject—*"Sand Testing and Its Relation to Casting Defects."*

4:00 PM (A) — Steel Session

(Sponsored by Steel Division)

Presiding—R. E. Kerr, Pettibone Mulliken Corp., Chicago.

Co-Chairman—G. W. Johnson, Vanadium Corporation of America, Chicago.

"Effect of Various Deoxidizers on the Structure of Sulphide Inclusions"—C. E. Sims, H. A. Saller, and F. W. Boulger, Battelle Memorial Institute, Columbus, Ohio.

"Effect of Aluminum and Vanadium on the Toughness of High Hardenability Cast Steel"—J. F. Wallace, Watertown Arsenal, Mass.

4:00 PM (B) — Gray Iron Session

(Sponsored by Gray Iron Division)

Presiding—W. A. Pennington, Carrier Corporation, Syracuse, N. Y.

Co-Chairman—W. W. Levi, Lynchburg Foundry Co., Radford, Virginia.

"Production and Consumption of Heat in the Cupola"—D. W. Gunther, National Radiator Co., Johnstown, Pa.

"Design and Operation of a 10-Inch Cupola"—D. E. Krause, Gray Iron Research Institute, Inc., and H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio.

4:30 PM — Registration Closes

7:00 PM — Annual Banquet

Presiding—W. B. Wallis, President, American Foundrymen's Society.

Presentation of A.F.S. Gold Medal Awards and Honorary Life Memberships. Speaker—The Hon. W. Stuart Symington, Secretary Air Force, Washington, D. C.

F. W. Boulger

A. E. Schuh

W. F. Bohm

J. S. Vanick

G. E. Tisdale

R. E. Kerr

N. L. Peukert

M. G. Dietl

A. W. Gregg

T. Giszczak

R. A. Quadt

S. L. Gertsman

CONVENTION PLANT VISITATIONS

FOURTEEN ST. LOUIS FOUNDRIES have extended an invitation to A.F.S. members and visitors attending the 53rd Annual Convention of the American Foundrymen's Society, St. Louis, May 2-5, to inspect their facilities and foundry operations.

Foundries of the St. Louis area, located in and around St. Louis, and in nearby Illinois towns have cooperated with the 53rd A.F.S. Convention Plant Visitation Committee of the St. Louis District Chapter to afford those attending the Convention the opportunity to observe such diversified foundry operations as steel casting for railroad equipment, carbon and low alloy steel casting, casting of equipment for oil refineries, bronze casting of railroad equipment, steel casting for mining and dredging equipment and gray iron casting for appliances and stoves.

Convention visitors desiring to visit the plants listed and described below are requested to register at the Plant Visitation Booth, Convention Headquarters.

American Steel Foundries, East St. Louis, Ill.:

Specialty steel foundry producing railroad truck bolsters and cast steel brake beams; 25-ton basic open hearth melting furnaces producing approximately 100 ton per day.

Open May 3 and May 5, 12 Noon to 4:00 p.m.

American Steel Foundries, Granite City, Ill.:

A specialty steel foundry producing railroad truck side frames and diesel electric locomotive castings. 30-ton basic open hearth melting furnaces, producing approximately 200 tons per day.

Open for visits May 2 and 3 from 1:00 p.m. to 4:00 p.m. Can be reached by Illinois Terminal car, leaving Illinois Terminal Building at 12th and Franklin Avenue.

General Steel Castings Corporation, Granite City, Ill.:

Produces large steel castings for railroads such as locomotive frames, car trucks, and other auxiliaries. Operates large machine shop.

Open 9:30 a.m. to 12 noon. Groups limited to 50 each. Can be reached by Illinois Traction street cars at terminal, 12th and Delmar. Leave car in Granite City at Madison Avenue and 14th Street. Walk two blocks west.

Scullin Steel Co., 6700 Manchester, St. Louis, Mo.:

Type of castings produced—railroad specialties, railroad locomotive and car castings, and miscellaneous industrial castings. Castings weight from 10 to 50,000 lbs. Also produce ingots for rolling mill use weighing from 1 to 12.5 tons. Monthly capacity 6,000 net tons of castings, 20,000 tons of ingots. Melting equipment—Four 30 ton and six 40 ton basic open hearth furnaces. Annealing equipment—Two 15 ton and one 7 ton car type natural gas fired furnaces. Operates own pattern shop and machine shop.

Open May 2nd, 3rd and 5th inclusive from 2:00 p.m. to 5:00 p.m. for plant visitation. Manchester street car passes plant at 6700 west. Visitors will start from lobby of General Office Building.

St. Louis Steel Casting Company, St. Louis, Mo.:

Jobbing foundry—product carbon and low alloy electric furnace steel.

Open May 2, 3, 4, and 5—1:00 to 3:00 p.m. Can be reached by cab or by taking the Olive Street Car from corner of 12th and Olive east to Broadway, then transferring to the Broadway Street Car going South. Get off at 6600 South Broadway. Plant is ½ block east of 6600 block on Broadway.

Sterling Steel Casting Co., East St. Louis, Mo.:

Jobbing steel foundry producing carbon and low alloy steel castings, average weight of 15 lb, melting with acid electric furnace.

Open May 2, 3, 4 and 5, 9:00 a.m. to 11:00 a.m., and 1:00 p.m. to 3:00 p.m. Five mile ride from the Jefferson Hotel. Can be reached only by taxi or if advance notice is given one hour before visiting time, transportation will be furnished by calling the company at Bridge 6900.

Key Company, East St. Louis, Ill.:

Produces oil refinery fittings and some commercial work such as special valve bodies, gates and segments. Have an acid electric furnace, and use jolt rollover machines and a sand slinger, green sand, and skin dried molds. Operates own pattern shop and machine shop with sand and chemical laboratories.

Transportation will be available morning and afternoon of May 3 and 4 for those who sign up to visit plant, preferably not over 15 in a group.

National Bearing Division, St. Louis.

One of the largest bronze foundries in the industry, operating both a sand foundry and a centrifugal casting foundry. Produces railroad car journal bearings, locomotive castings, diesel bearings, bearings and wearing parts for the coal mining industry, electric furnace castings and general industrial castings of practically all of the bronze alloys

Open for visit by not more than forty men on Tuesday, May 3 between 10 a.m. and noon. Kings-highway bus, Taylor bus or Manchester street cars pass in front or close to location of plant.

Carondelet Foundry Company, St. Louis.

Specialty jobbing foundry producing diversified line of gray iron castings, light and medium weight. Melt by cupola and electric furnace. Not continuous pour and not mechanized.

Open May 3-5 between 10:00 a.m. and 2:00 p.m.

American Manganese Steel Division, American Brake Shoe Co., St. Louis.

Jobbing foundry producing manganese steel castings used in the mining, dredging, steel, petroleum, and railroad industries. Castings weighing a few ounces to 7,000 lb are produced, melting being done in basic electric furnaces. Produces dippers and dipper parts, crusher parts, chain, screens, car wheels and sheave wheels. Operates own machine shop, pattern shop and chemical laboratory.

Open for visit from 1:00 p.m. to 3:30 p.m. Plant may be reached by taxi, bus, or surface cars. Easton Avenue and Hodiamont streetcars go to the Wellston Loop, which is nearby. Jennings Bus can be boarded at Delmar Loop and stops within a half block of the plant.

East St. Louis Castings Company, East St. Louis, Ill.:

Mechanized foundry producing light gray iron castings for electrical appliances, stove fittings, pumps, and so forth, continuous pouring, melting about 40 tons per shift, by cupola.

Foundry may be reached from Jefferson Hotel by crossing the Eads Bridge onto Broadway Ave. in East St. Louis, north on Tenth Street to St. Clair Ave. which is Route 50, and east on St. Clair Ave. to 4200.

The following plants are open to visitation by invitation or appointment only:

American Car & Foundry Co., St. Louis.

Century Foundry, St. Louis.

Fulton Iron Works, St. Louis.

CORRECTION, PLEASE

THE STORY of the first postwar International Foundry Congress appearing in AMERICAN FOUNDRYMAN, December, 1948, pages 24-25, incorrectly reports that the president of the International Committee of Foundrymen's Associations for 1949 would be Dr. Leonard of Belgium. The 1949 president of the committee is R. Deprez, president of the Belgian Technical Foundry Association. He was committee vice-president in 1948.

W. Stuart Symington

Annual Banquet Speaker

ANNUAL BANQUET SPEAKER at the 53rd Annual Convention of the American Foundrymen's Society will be one of the nation's outstanding public figures—the Honorable W. Stuart Symington, United States Secretary of the Air Forces.

It is particularly fitting that Secretary of the Air Force Symington has been chosen to deliver the Annual Banquet address, climaxing the 53rd A.F.S. Convention, for his career as an industrialist has been closely allied with the metals industry.

Distinguished Career as Industrialist

Prior to his appointment as chairman of the Surplus Property Board in 1945, and subsequently as Assistant Secretary of War, Mr. Symington was president and chairman of the board of directors of the Emerson Manufacturing Co. in St. Louis, host city to the 53rd Convention of the American Foundrymen's Society.

Born in 1901 at Amherst, Mass., Mr. Symington attended Baltimore (Md.) City College, graduating early in 1918. He enlisted at once in the Army as a private, and at the age of 17 became one of the Army's youngest second lieutenants. Following the war, he entered Yale University.

In 1923 Mr. Symington went to work in the shops of the Symington Co., Rochester, N. Y., owned by his uncle, where he engaged in the manufacture of malleable iron products. He left there two years later to form Eastern Clay Products, Inc., but in 1927 returned to the Symington Co. as assistant to the president.

Mr. Symington resigned in 1930 to become president of the Colonial Radio Corp., now a manufacturing division of Sylvania Electric Products.

In January, 1935, he accepted the presidency of Rustless Iron and Steel Corp., the country's largest manufacturer of stainless steel, meanwhile remaining a director of Colonial Radio Corp.

When the Rustless Iron and Steel Corp. was sold to the American Rolling Mill Co. in 1937, Mr. Symington resigned to become president of the Emerson Electric Manufacturing Co. of St. Louis, where he has made his home since.

Early in 1941, at the request of the Army, the Navy, and the Office of Production Management, Mr. Symington went to England with a group of aeronautical engineers to study the then-new art of gun turret manufacture for military planes.

Mr. Symington returned from England to the United States in June, 1941, to build the world's largest airplane armament plant in St. Louis as part of the Emerson Co. During the war, the company produced power-driven turrets to provide American bombers with protective fire power.

Mr. Symington's varied industrial experience and his company's war production record led to his appointment as chairman of the original three-member Surplus Property Board on July 16, 1945. On Oct. 1 of that same year, when Congress created the Surplus Property Administration, Mr. Symington was named Administrator. The task of this organization was to formulate the policies under which Government agencies disposed of surplus war properties.

First U. S. Secretary of Air Force

On Jan. 31, 1946, Mr. Symington was appointed Assistant Secretary of War for Air, and on Sept. 18, 1947, he was appointed the first Secretary of the Air Force in United States history.

Mr. Symington's address will be the highlight of the Annual Banquet, climaxing the 53rd Annual Convention of the American Foundrymen's Society. In addition, the Banquet will feature the presentation of three A.F.S. Gold Medals and four Honorary Life Memberships in the American Foundrymen's Society.

John Howe Hall

Charles Edgar Hoyt Annual Lecturer

One of the first A.F.S. Gold Medalists and a pioneer in the development of many of the basic steel casting practices in use today is this year's Charles Edgar Hoyt Annual Lecture speaker—John Howe Hall, foundry consultant of Swarthmore, Pa. Mr. Hall will speak on *"Steel Castings in Welded Assemblies"* at the Annual Business Meeting, to be held May 4 during the 53rd Annual Convention of the American Foundrymen's Society, St. Louis, May 2-5.

First A.F.S. Whiting Medalist

The first recipient of the A.F.S. John H. Whiting Gold Medal, in 1924, for "outstanding contributions to the steel casting industry," Mr. Hall has a distinguished record in this field. Among his many pioneering achievements in the field of steel metallurgy are the use of intermediate manganese steel in castings, introduction of the practice of quenching and reheating of alloy steel castings, development of a welding rod for manganese steel, melting of ferro-manganese in the cupola, first successful use of an electric furnace for the melting of manganese steel, and the remelting of manganese steel scrap in an electric furnace.

A graduate of Harvard University in 1903, Mr. Hall received his master's degree there the following year—all in four years. In 1905, he spent a year at Harvard under Prof. Albert Sauveur doing research work into the manufacture and properties of vanadium steel.

From 1904 to 1906, Mr. Hall was employed by the Bethlehem Steel Co., where he acquired a broad background of practical foundry knowledge.

After a summer spent working in a small Buffalo, N. Y., foundry, Mr. Hall entered the laboratory of the Taylor-Wharton Iron & Steel Co. in 1906, and was employed by that organization until 1937, with the exception of the years 1913 and 1914, when he was engaged in practice as a consulting metallurgist in New York City. In 1937 he resumed consulting practice, interrupting this in 1942 to 1945 to act as assistant metallurgist for General Steel Castings Corp.

During his first eight years with Taylor-Wharton, Mr. Hall worked directly under the supervision of his uncle, the late Henry M. Howe, who was for many years vice-president and consulting metallurgist. It was during this period that Mr. Hall developed and perfected many steel casting practices.

Subsequently, when Taylor-Wharton's Easton (Pa.) foundry was put into operation, Mr. Hall developed several new methods of producing alloy steels in a side-blow converter, including economical means of incorporating nickel, vanadium and chromium in the converter process. Later Mr. Hall devised a means by which small castings were poured directly from a coreless induction melting furnace without taking the current off the furnace.

Developed Many Casting Processes

Mr. Hall was responsible for introducing the continuous type of heat treating furnace for manganese steel castings—a method that has resulted in large fuel economies and in great improvement in heat treatment, which is carried out in furnaces of this type with far less surface oxidation than in the old batch furnaces. This recent development of Mr. Hall's has resulted in economy of floor space and increased tonnage.

Active in many technical societies and widely-known as an author and speaker, Mr. Hall is today a leading consultant to the steel foundry industry.

Conferral of the 1949 Hoyt Lectureship, one of the highest honors accorded by the American Foundrymen's Society, upon one of the industry's most distinguished sons makes the 1949 Lecture, *"Steel Castings in Welded Assemblies,"* an outstanding technical event of the 53rd A.F.S. Convention.

AWARDS

Gold Medal and Honorary Life Membership

To Russell J. Anderson
The Peter L. Simpson Gold Medal

"for outstanding service to the Society and in the public interest as Chairman of the Wisconsin Chapter and of the Wisconsin Centennial Foundry Committee."

Mr. Anderson is Works Manager of the Belle City Malleable Iron Co., Racine, Wis., and has long been active in the affairs of the American Foundrymen's Society. As Chairman of the Wisconsin Chapter last year he was instrumental in establishing the foundry exhibit at the Wisconsin Centennial Exposition—an outstanding contribution towards fostering public interest in the foundry industry.

To Gosta Vennerholm
The Wm. H. McFadden Gold Medal

"for outstanding contributions to the castings industry in the field of ferrous metallurgy and practice."

A native of Sweden, Mr. Vennerholm graduated from Technical College, Stockholm, and taught in Germany before coming to the United States in 1924 to work in the physical laboratories of the Ford Motor Co., Dearborn, Mich. During his 25 years with the Ford Motor Co., he has risen to his present position as Supervisor of Metallurgical Research, and has been the co-discoverer of many cast alloys and casting methods in the ferrous field. Internationally-known as an authority on metallurgy and metallurgical control of ferrous metals, Mr. Vennerholm has been a frequent speaker on these subjects at chapter, regional and national meetings of the American Foundrymen's Society.

To S. C. Massari
The John H. Whiting Gold Medal

"for outstanding contributions in the field of ferrous metallurgy, molding and foundry practice and service to the wartime foundry industry with the Chicago Ordnance District."

Mr. Massari is Technical Director of the American Foundrymen's Society and was for 18 years Research Metallurgist for the Association of Chilled Car Wheel Manufacturers. With the advent of World War II, Mr. Massari was commissioned a Captain with the Chicago Ordnance District and placed in charge of Armor Production. His long experience and technical knowledge of ferrous casting won him the Legion of Merit for his services, and by war's end he was appointed Lieutenant Colonel and Assistant Chief of the Tank Automotive Branch of the Chicago Ordnance District. Prior to becoming Technical Director of A.F.S., Mr. Massari had been active for many years on A.F.S. National Technical Committees and a frequent speaker at technical meetings. He is the author of a number of papers on the metallurgy of white and gray iron, chilled iron and cupola control.

To A... HASWELL
Ho... Life ...ship

"...outst...nding and inspiring ser...ce to ... industry
...President of ... Foundry Educati...al Foundation."

...ident of the Di... Mall... Iron Co. s...ce 194..., Mr. Haswell has long
...en active in efforts to ...terest engineering school graduates in the foundry
industry as a career. He w... instrumental in the formation of
the Foundry Educational Foundation, and in recognition of his efforts
...this field was elect... ...e f... President of that organization in 1946.

To Dean Clem...
Honorary Life Membership

"for sincere and constant service on behalf of the castings
industry by encouraging youn... ...ndry trade."

Dean of the University of Detroit ... of Engineering, Mr. ... has
a long and distinguished rec... ...ucational ... as a coun-
sellor to young men enterin... ...many
years been active in the ... ...'s Society and o... techn..., edu-
cational and State organi... as ... member of national advisory ...mmittee...
He is a member of the ... Executive Com...ttee of ... A.F.S. ...ucational Division.

To Ralph L. Lee
Honorary Life Membership

"for steadfast and contin...ous ser... ... the Societ...
castings industry in the field of ..."

Mr. Lee is Secretary-Treasurer of Grede Foundries Inc., Milwaukee, and
as Chairman of the A.F.S. Foundry Cost Committee for many years has
been instrumental in the development and publication of recommended foundry
cost practices. An internationally-known authority on the subject.
Mr. Lee has been a frequent speaker before A.F.S. meetings and
author of many articles appearing in the technical press on found...
control. In 1948, he was chosen to present the Exchange Pa...
American Foundrymen's Society to the Institute of Briti... Foundrymen.

To W. B. Wallis
Honorary Life Membership

"upon completion of his term as Presid... of ... American Found... Society."

A.F.S. National President Wallis, during his te... of office, has maintained
close contact with the membership of the Societ..., attending chapter,
regional and national gatherings, meeting leaders ... the f... industry,
chapter officers and members and acting as liaison ...
American Foundrymen's Society, the industry and oth...
By completion of his term as President, Mr. Wallis expec...
visited each of the 40 chapters and seven student chapters of ...

INTERNATIONAL EXCHANGE PAPERS

TWO INTERNATIONAL EXCHANGE PAPERS, one from England and one from Australia, will be featured at technical sessions of the 53rd Annual Convention of the American Foundrymen's Society in St. Louis, May 2-5. A. W. Silvester, chief metallurgist, Russell Manufacturing Co., Pty., Ltd., Melbourne, Australia, will present the Exchange Paper of the Institute of Australian Foundrymen to A.F.S. at the 10:00 a.m. Gray Iron Division Session, Thursday, May 5, on *"Graphitization of Gray Cast Iron by Heat Treatment."*

"The Properties of Cast Iron in Relation to the Carbon Equivalent Value" will be the title of the Institute of British Foundrymen's Exchange Paper to the American Foundrymen's Society, to be presented at the 4:00 p.m. Gray Iron Session, Wednesday, May 4, by Dr. H. T. Angus, development manager, F. Dunn and D. Marles, all members of the British Cast Iron Research Association.

The reciprocal Exchange Paper of the American Foundrymen's Society to the Institute of Australian Foundrymen, *"Controlled Sand Produces Quality Castings"* has been prepared by Bradley H. Booth, foundry engineer, Carpenter Brothers, Inc., Milwaukee. Mr. Booth will not, however, be present at the reading of his Exchange Paper at the Annual Meeting of the Institute of Australian Foundrymen.

A. W. Silvester

B. H. Booth

A. J. Smith

A. W. Gregg

Simultaneously, it is announced that two other A.F.S. members have been selected to present Exchange Papers from the American Foundrymen's Society—Alfred W. Gregg, executive engineer, Foundry Equipment Department, Whiting Corp., Harvey, Ill., will present a paper on *"Melting Furnaces in Ferrous Foundries"* at the International Foundry Congress, to be held in Amsterdam, Holland, this summer—and Austen J. Smith, associate professor, Department of Chemical and Metallurgical Engineering, Michigan State College, has been selected to present the 1949 Exchange Paper of the American Foundrymen's Society to the Institute of British Foundrymen, *"Some Problems in Bronze Foundry Practice."*

'49 International Foundry Congress To Be Held in Amsterdam, Holland

THE DUTCH TECHNICAL FOUNDRY ASSOCIATION will be host to the 1949 International Foundry Congress, to be held in Amsterdam, August 29-September 2, at the Royal Institute of the Indies.

Featured sessions will be those on Control and Research in the Foundry, Organization of Foundries, Sand Preparation, Non-Destructive Testing, Mechanization of Foundries, and Melting Furnaces in Metal Foundries. A large part of the Congress will be devoted to excursion trips through Dutch foundries.

Meeting during the Congress will be the International Committee of Foundry Technical Associations, the International Committee on Testing Cast Iron, and the International Committee on Foundry Defects. Detailed information on the meetings of these three Committees is available from Tom Makemson, St. John Street Chambers, Deansgate, Manchester, 3, England.

Technical papers for presentation at the Congress must be submitted before May 1 in English, French or German. Other requirements are (1) papers must be written in four copies (2) limited to 10,000 words (3) if lantern slides are used they must be of standard dimensions (83 x 83 mm). Advance notice of the name, profession and title of the author and his subject must be given as soon as possible to the president of the Technical Papers Committee: Prof. Dr. Ir. W. F. Brandsma, Metallographisch Laboratorium of the Technische Hoogeschool, Nieuwe Laan 76, Delft, the Netherlands; or to the Secretary, Drs. A. Ph. Krijff, Emmalaan, 7, Nijmegen, the Netherlands. All other correspondence, such as that regarding registration, hotel reservations, etc., should be addressed to The Secretary, Gieterij-Congress 1949, Keizersgracht 192 te Amsterdam-C.

In addition to the technical and plant visitation programs, there will be a Ladies' Program running throughout the Congress, an afternoon trip through Amsterdam, a trip by excursion steamer through the canals of Amsterdam and excursion to the airport at Schiphol, and the Final Banquet. Members who so desire are invited to remain in Holland the week following the Congress for the International Industries Fair, to be held at Utrecht, September 6-15, and which will feature several exhibits of foundry products.

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F. C. Riecks, Manager of Foundry Operations, Ford Motor Co., Dearborn, Mich.

(Terms expire 1951)

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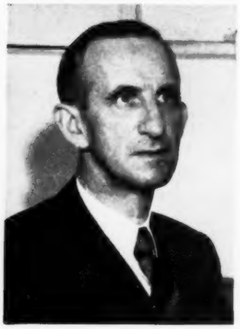

H. G. Lamker

A. C. Ziebell

B. L. Simpson

N. J. Dunbeck

Robert Gregg

Max Kuniansky

H. A. Deane

S. C. Wasson

W. J. MacNeill

J. E. Kolb

V. E. Zang

to the 1949 Foundry Congress . . .

A. L. Hunt

G. N. Shepherd

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F. E. Abraham, American Steel Foundries, Granite City, Ill.
George L. Mitsch, American Car & Foundry Co., St. Louis.

(Continued on the following page)

G. A. McMillan

R. E. Woods

C. A. Pfanstiel

L. C. Farquhar, Sr.

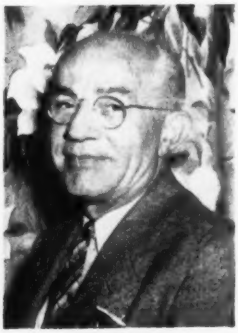
R. L. Jones

F. E. Abrahams

H. C. Sanders

J. H. Williamson

H. W. Meyer



P. E. Retzlaff

N. L. Peukert

E. J. Aubuchon

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Harry E. Thiele, General Steel Castings Corp., Granite City, Ill.
Joseph Walsh, Scullin Steel Co., St. Louis.
Claude L. Harrell, Sterling Steel Casting Co., St. Louis.
L. C. Farquhar, Sr., American Steel Foundries, Granite City, Ill.
B. J. Gross, The Key Co., St. Louis.
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C. B. Shanley, Semi-Steel Casting Co., St. Louis.
T. W. Pettus, National Bearing Division, American Brake Shoe Co.
Paul Kluge, Tower Grove Foundry, St. Louis.
Roy A. Jacobsen, Carondelet Foundry Co., St. Louis.
N. H. Luedinghaus, St. Louis Malleable Casting Co., St. Louis.

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Co-Chairman: Marshall Reichert, Banner Iron Works, St. Louis.

A. S. Hard

J. F. Gilbert

G. W. Mitsch

C. B. Shanley


G. L. Mitsch


R. M. Hill


W. L. Kammerer


Harry Hampe

PLANT VISITATION COMMITTEE

Chairman: Luther A. Kleber, General Steel Castings Corp., Granite City, Ill.
Co-Chairman: Walter A. Zeis, Walter A. Zeis Co., St. Louis.
I. E. Watson and R. B. Cottrell, East St. Louis Works, American Steel Foundries, East St. Louis, Ill.
R. E. Chapman and R. O. Tibbals, Granite City Works, American Steel Foundries, Granite City, Ill.
Frank Foley and G. W. Highfield, General Steel Castings Corp., Granite City, Ill.
T. E. Padkins and T. A. Mahon, Scullin Steel Co., St. Louis.
Frank W. Ladwig and Leonard A. Neel, St. Louis Steel Casting Co.
J. O. Shive and James Baldwin, Sterling Steel Casting Co., St. Louis.
A. T. Amlung and D. L. Cahill, The Key Co., St. Louis.
Wilbur C. Pickles and Ray Robertson, National Bearing Division, American Brake Shoe Co., St. Louis.
Oliver P. Huegerich and Homer L. Fraley, American Manganese Steel Division, American Brake Shoe Co., St. Louis.
Lloyd Farquhar, Jr., and Fred Huskey, East St. Louis Castings Co., East St. Louis, Ill.
M. B. Shea and C. A. Pfanstiel, Fulton Iron Works, St. Louis.
H. A. Steinbrick, Century Foundry Co., St. Louis.
C. W. Gullickson, Sterling Wheelbarrow & Flask Co., St. Louis.
Jess F. Donnell, Hickman, Williams & Co., Inc., St. Louis.
A. E. Hilliard, M. A. Bell Co., St. Louis.

LADIES' ENTERTAINMENT COMMITTEE

A complete listing of Ladies' Entertainment Committee Personnel will be found on Page 64 of this issue of AMERICAN FOUNDRYMAN.


W. A. Zeis


L. A. Kleber

T. W. Pettus

Paul Schwarz

Walter Siegerist

C. E. Rothweiler

A GALA ROUND OF ENTERTAINMENT, including a tea, luncheon and fashion show and an afternoon's tour of the scenic spots at historic old St. Louis, will make up the Ladies' Entertainment Program during the 53rd Annual A.F.S. Convention in St. Louis, May 2-5.

The program will open the afternoon of May 2 with a tea at which visiting ladies will have an opportunity to get acquainted with each other and to meet their hostesses for the Convention—ladies of the A.F.S. St. Louis Chapter.

On Tuesday, May 3, a luncheon and Intimate Fashion Clinic and Workshop will be given at the Missouri Athletic Club, under the direction of Miss Martha Deppe, fashion director for Stix, Baer & Fuller, one of St. Louis' largest stores. An informal showing of style and fashion trends for the ensuing season will be accompanied by a running commentary dealing with typical fashion trends. Guests will be urged to ask questions as to personal applications of the types of styling and fashions demonstrated.

Mrs. A. L. Hunt

Mrs. W. L. Kammerer

Mrs. E. J. Aubuchon

Mrs. E. A. Williams

Mrs. G. W. Mitsch

Features Tour of Old St. Louis

Starting from the Hotel Jefferson at 1:00 p.m. on Wednesday, a conducted tour of the scenic and historic points of interest of St. Louis will take lady guests of the Convention to the Old St. Louis Cathedral, the Eugene Field House, the St. Louis Art Museum, Forest Park, the Jefferson Memorial, Washington University, the site of Camp Jackson, St. Louis University, the Jewel Box, and the historic Old Court House, where slaves were sold on the steps in early days and where Abraham Lincoln delivered a fiery address against slavery during his first Presidential campaign.

As in past years, lady guests of the Convention are invited to attend the Annual Banquet the evening of May 5, at which A.F.S. Gold Medals and Honorary Life Memberships will be presented and the Honorable W. Stuart Symington, United States Secretary for Air, will deliver the Banquet Address.

Registration for the Ladies' Entertainment Program will take place from 9:00 a.m. to 5:00 p.m. on Monday, May 2. There will be a registration fee of $5, which will defray the complete cost of all events, a program and souvenir of the occasion.




Mrs. G. A. McMillan | **Mrs. C. R. Culling** | **Mrs. Richard Jones** | **Mrs. Ralph Hill, Jr.**

LADIES' ENTERTAINMENT COMMITTEES

53rd Annual Convention of the American Foundrymen's Society

St. Louis — **May 2-5**

GENERAL ARRANGEMENTS

Mrs. A. L. Hunt, *Chairman* — Mrs. E. J. Aubuchon, *Vice-Chairman*
Mrs. Walter Zeis, *Secretary-Treasurer*

REGISTRATION

Mrs. Richard Durkan — Mrs. George W. Mitsch, *Chairman* — Mrs. Harry Sanders

TEA COMMITTEE

Mrs. W. L. Kammerer, *Chairman* — Mrs. C. R. Culling
Mrs. C. A. Kenyon — Mrs. Gordon McMillan — Mrs. L. C. Farquhar, Sr.

FASHION CLINIC

Mrs. Ralph Hill, Jr., *Chairman* — Mrs. C. B. Martin, Jr.
Mrs. Richard Jones — Mrs. Robert Woods

TOUR COMMITTEE

Mrs. E. A. Williams, *Chairman* — Mrs. Paul Schwarz
Mrs. L. E. Kleber — Mrs. Norman Peukert — Mrs. C. B. Martin, Jr.

RECEPTION

Mrs. J. F. Gilbert, *Chairman*




Mrs. Harry Sanders | **Mrs. C. A. Kenyon** | **Mrs. C. B. Martin, Jr.** | **Mrs. Richard Durkan**

Mrs. Paul Schwarz | **Mrs. J. F. Gilbert** | **Mrs. Robert Woods** | **Mrs. L. E. Kleber**




EXPANDING RESEARCH PROGRAM ADVANCES FOUNDRY INDUSTRY

Foundry fundamentals are the goals of the eight A.F.S.-sponsored research projects in operation in United States and Canadian technical institutions. The ninth project, approved recently, will get under way as soon as a research organization has been selected. Initiated largely after authorization of the general plan by the Board of Directors in July, 1946, the projects are under the direction of research committees of the several Society divisions.

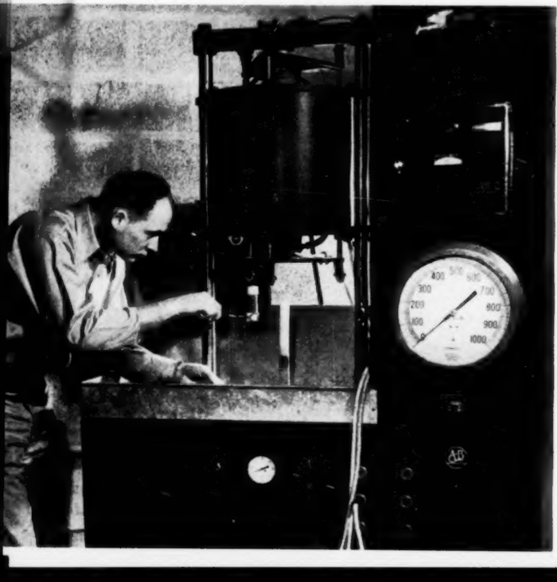
Published results of the program include the 470-page Handbook of Cupola Operation, eight extensive reports on high temperature testing and properties of sands, and four detailed reports on heat transfer and solidification of molten metal in sand molds.

Results of the research work, which are available to all foundrymen, are expected to continue to advance the industry through development of improved and new foundry techniques. Reports on most of the projects are scheduled for the 1949 A.F.S. Annual Convention, May 2-5, in St. Louis.

Oldest A.F.S. research project is that on high temperature properties of steel molding sands carried on at Cornell University since 1936 under the Sand Division. Second to be established was the Cupola Research Project, formally proposed to the Board in July, 1939, and under the Gray Iron Division. As the result of a paper on foundry heat flow problems at the 1944 Annual Convention, the work now carried on under the Heat Transfer Committee was approved in July of that year.

The research program has expanded rapidly in the past two years and now includes the following six additional projects: mechanics of molten metal flow in molds, sponsored by the Aluminum and Magnesium Division; a study of the fracture test as an indication of the quality of tin bronzes, Brass and Bronze Division; centrifugal casting of light alloys, Centrifugal Castings Committee of the Aluminum and Magnesium Division; best microstructure for selective hardening of pearlitic malleable iron, Malleable Division; and influence of mold conditions on development of hot tears in steel castings, Steel Division.

Study of sand behavior at elevated temperatures in the Sand Research Project helps foundrymen avoid scabs, buckles, washes and other common casting defects.



P. E. Kyle

C. B. Jenni

Invitations to bid on the newest project—gating and risering of gray iron castings, sponsored by the Gray Iron Division—recently were sent out.

Practical value of A.F.S.-sponsored research is described in this article in summaries prepared by the chairmen of the various research committees. Date and time of each Convention research report are shown in the tabulation on page 67.

The foundry art—rapidly becoming a science—has accumulated through the ages a strange assortment of information on mold and core sand mixtures. Some of the practices in use today produce excellent results for they are the result of gradual improvement through

trial and error methods, correlation with castings produced and use of common sense.

With the advent of scientific control methods, more rigid inspection standards, and economic pressure for reduction of defective castings, the foundry industry is approaching its sand problems from a new point of view. Under the Sand Division, A.F.S. has sponsored a three-fold research program on the high temperature properties of steel molding sands.

The three parts of the sand research program are: 1. A fundamental study of the behavior of molding sands when heated and cooled and the effect of time on the reactions; 2. A critical study of expansion-contraction characteristics of molding sand; 3. A critical study of determination of hot compressive

R. G. McElwee

J. S. Vanick

strength with the view of establishing a tentative standard test procedure.

Part 1 is of utmost importance for fundamentals must be established before the foundry industry can attack its problems intelligently with any assurance of success. Part 2 is directly related to the common casting defects such as scabs, buckles and rat tails. The third phase of the work—establishing an adequate testing procedure—is necessary if any degree of sand control is to be exercised. Much of the work on hot compressive strength has involved the factors influencing the reproducibility of results and many of these have been described in the annual reports published in TRANSACTIONS of the Society.

In direct charge of the work at Cornell University, Ithaca, N. Y., is P. E. Kyle, vice-chairman of the Sand Division and a member of committees in the Education and Aluminum and Magnesium Divisions. J. P. Fraser, graduate student, is working on the project.

Directing the Sand Research Project is the Committee on Physical Properties of Steel Foundry Sands at Elevated Temperatures headed by Clyde B. Jenni, General Steel Castings Corp., Eddystone, Pa. Vice-chairman of the group is H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa. Committee members are: C. W. Briggs, Steel Founders' Society of America, Cleveland; H. W. Dietert, Harry W. Dietert Co., Detroit; Werner Finster, Textile Machine Works, Reading, Pa.; Prof. Kyle; R. E. Morey, Naval Research Laboratory, Washington, D. C.; J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.; and H. F. Taylor, Massachusetts Institute of Technology.

Simple, rapid analysis of cupola gases with an Orsat-type apparatus is one of the tests used in the Cupola Research Project to indicate combustion conditions.

The popular HANDBOOK OF CUPOLA OPERATION, sold out in two years and now being reprinted, is the second phase of the Cupola Research Project. First step was a comprehensive study of literature pertaining to cupola operation. This information was combined with data supplied by 128 metallurgists and cupola operators to make up the HANDBOOK. The third phase of the work is well under way, utilizing a full time research worker and involving cooperative work with a number of organizations.

While a study of fuels and influence of coke heredity is the major subject of the cupola Research Project the committee has felt that any factor contributing to better, more efficient cupola operation must be included in the investigation. During the year, work has shown that slag viscosity is a factor in carbon pickup and is related to amount of combined carbon in the iron as well as its final structure. Pancake slag

Convention Schedule of A.F.S. Research

Monday, May 2

10:00 a.m.—Malleable Session

"Surface Hardening of Pearlitic Malleable Iron"—Progress Report.

12:00 noon—Aluminum and Magnesium Round Table Luncheon

"Fluid Flow in Transparent Molds"—Motion Picture and Progress Report.

4:00 p.m.—Brass and Bronze Session

"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass"—Progress Report.

Tuesday, May 3

10:00 a.m.—Heat Transfer Session

"Comparative Solidification Studies"—Progress Report—and *"The Foundryman and Heat Transfer."*

2:00 p.m.—Sand Session

"Elevated Temperature Properties of Steel Molding Sands"—Progress Report.

Wednesday, May 4

4:00 p.m.—Gray Iron Session

Cupola Research Progress Report.

The heat and mass flow analyzer used in the Heat Transfer Project enables difficult foundry heat flow problems to be simulated by means of electrical circuits.

tests and a modified Herty viscosimeter are under investigation. Ultimate goal is to determine the relationship between iron and cupola slag and a means of controlling it.

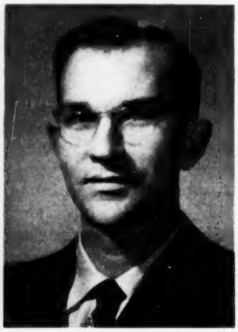
Two 30 ton lots of experimental coke supplied by the Ford Motor Co., Dearborn, Mich., have been put through production tests at the foundry division of Eaton Manufacturing Co., Vassar, Mich. Laboratory tests were conducted at Battelle Memorial Institute, Columbus, Ohio, through the cooperation of the Gray Iron Research Institute. The cokes, representing two coking times and two blends, were also tested at the U. S. Bureau of Mines and at the Canadian Bureau of Mines. The Canadian Bureau has worked out an electrical conductivity test for coke.

Air pollution ordinances enacted by various municipalities are under survey by the Cupola Research Committee, as are devices marketed for the control of cupola stack emissions.

Work on standardization of chill tests indicates that a wedge type of chill test specimen gives a good indication of the chemistry of the iron if the cupola is not being operated on a borderline iron-coke ratio.

R. G. McElwee, Vanadium Corporation of America, Detroit, is chairman of the Cupola Research Committee and is also actively directing the research work. Researcher is Thaddeus Giszczak. Members of the committee are: A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N. J., vice-chairman; E. H. Stilwill, Chrysler Corp., Detroit, secretary; A. L. Boegehold, General Motors Research Laboratories, Detroit; H. Bornstein, Deere & Co., Moline, Ill.; E. C. Jeter, Ford Motor Co., Dearborn, Mich.; and Carl F. Joseph, General Motors Corp., Saginaw, Mich.

L. W. Eastwood

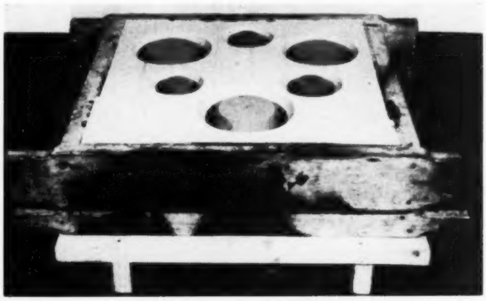


R. F. Thompson

Purpose of the increasingly popular heat transfer investigation is to assist in solving the problems of making sound castings. To feed castings it is necessary that progressive freezing occur—freezing should begin at points remote from the feeder and progress toward the place where liquid metal is still in the riser.

Although good work has been done in past years on the rate at which castings of various kinds would freeze in molds made of various materials, this approach to the problem is not entirely satisfactory. First, the execution of bleeding tests, even in the simplest shapes, is not a satisfactory procedure, especially in alloys which freeze over a long temperature range. Second, the results obtained in one shape of mold are not readily applicable to something else.

The theory of heat transfer is quite well understood but its application to foundry problems is so complex, especially on mathematical grounds, that it has not appealed to foundry engineers as a good approach to the problem. An additional difficulty is that the values of the physical constants which determine the rate of dissipation of heat are not too well known, either for the casting alloys or for the mold refractories.



Cores of varying hardness test the influence of mold conditions on the hot tearing of steel castings. Before pouring, the mold is topped with a runner assembly.

One laboratory in this country, at Columbia University, has facilities—the heat and mass flow analyzer—which remove the mathematical obstacles to heat transfer studies. The analyzer is being used to determine the rate at which simple forms of castings of various materials should freeze. In comparing the calculated data with the results of bleeding tests, the agreement has been good in some cases, not so good in others. It is quite likely that where agreement is not good the difficulty lies in the execution of the bleeding tests rather than in the computation.

Indications have been found that the effect of chills

is by no means as simple as was supposed, and that early in freezing there occurs a separation of the chill from the metal. This is probably due to the quick shrinkage of the metal and it retards the rate at which the chill can cool the casting. The problem will probably receive prompt attention by the Heat Transfer Committee.

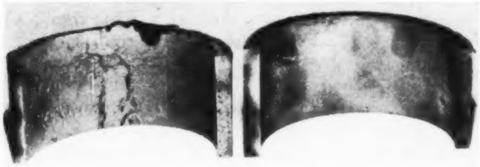
The second phase of the Committee's work will no doubt be the encouragement of investigation, especially in educational institutions, of the thermal properties of metals. These will include investigation of the liquid state and the rate of heat transfer, called the "apparent diffusivity," in mold materials.

Auxiliary heat transfer research has been conducted at Aluminum Company of America, Cleveland, Naval Research Laboratory, Washington, D. C., National Malleable & Steel Castings Co., Cleveland, and Battelle Memorial Institute, Columbus, Ohio.

In addition to the Convention report on the Heat Transfer Project, there will be a paper by V. Paschkis, technical director of the heat and mass flow analyzer laboratory at Columbia University, New York, which is expected to interest and instruct foundrymen in the fundamental physical processes of heat transfer. Dr. Paschkis is directing the investigation at Columbia.

H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, is chairman of the Heat Transfer Committee. Members of the committee are: J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio; Howard F. Taylor, Massachusetts Institute of Technology; E. C. Troy, Palmyra, N. J.; Dr. Paschkis; and A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N.J.

Two years ago the Aluminum and Magnesium Division's Research Committee began to study the fundamentals of fluid flow in molds. A research program was laid out to investigate the broad general principles involved and was planned in units of about one year's duration with the objective of ultimate integration over a period of about five years. The first unit has been completed, the second is in progress and the third is now being planned to begin in September.



Bisected, etched test castings made on the Steel Research Project show hot tears from resisting core (left) and sound casting made with collapsible core.

Goal of the research is to derive optimum design conditions for introducing metal into mold cavities. It is intended that the principles evolved should be applicable to ferrous and non-ferrous castings.

The initial project was placed at Battelle Memorial Institute, Columbus, Ohio, after a careful examination of all available facilities. The work was carried out by Roy E. Swift under a cooperative doctoral fellowship arrangement with Yale University, Battelle Memorial

V. Paschkis

H. A. Schwartz

Institute and the American Foundrymen's Society. Battelle contributed about one-third and American Foundrymen's Society about two-thirds of the financial support. The work was under the supervision of L. W. Eastwood of Battelle, with W. R. Hibbard of Yale University as faculty adviser to Mr. Swift.

For the first part of the work, it was decided to use a transparent mold material (lucite) and initial work was done with water to permit observation of flow characteristics. Toward the end of the first year some work was carried out with Wood's metal in the lucite mold. Observation of flow conditions was recorded by a moving picture camera and the first public report, at the Convention in St. Louis, will include showing the film.

Most of the data obtained to date has been on flow conditions prevailing in various designs of downsprues and runners. The movies show clearly the turbulence created, the vortex produced and the air entrained under several sets of pouring conditions. They also disclose proper sprue and runner geometry for minimizing these factors. The second unit of the work, currently in progress, will place emphasis on runner and gate design for smoothest flow of molten metal.

Motion pictures provide complete visual evidence of behavior of flow in special transparent plastic mold used on Aluminum and Magnesium Research Project.

Assembling a test mold at the Canadian Bureau of Mines prior to a centrifugal casting run on an aluminum alloy. Work may lead to better properties.

It is anticipated the work covered in the third unit will attempt to translate the fundamentals derived to flow of metal in conventional mold materials.

Men on the Research Committee of the Aluminum and Magnesium Division to date have spent 65 man-days in meetings. Members of the committee headed by R. F. Thomson, International Nickel Co., Detroit, are: W. E. Sicha, Aluminum Company of America, Cleveland; T. D. Stay, Reynolds Metals Co., Cleveland; W. J. Klayer, Aluminum Industries Inc., Cincinnati; W. Bonsack, Apex Smelting Co., Cleveland; Dr. Eastwood; C. E. Nelson, Dow Chemical Co., Midland, Mich.; and R. E. Ward, Bendix Aviation Corp., Teterboro, N. J.

Study Mold Influence On Hot Tears

The project chosen by the Research Committee of the Steel Division is a fundamental study of the influence of mold conditions on the development of hot tears in steel castings. Under investigation are such factors as mold collapsibility, sand grain size and distribution, moisture content, mold hardness, binders, hot strength, density and many others. Outcome of the research should be quantitative data, to replace the rule-of-thumb information generally utilized, and methods for the control of hot tearing. In addition, the study is expected to develop a pattern design which can be used to measure susceptibility of a given steel to formation of hot tears.

Factors outside the mold—metal analysis, pouring temperature, melting technique, etc.—are being kept as uniform as possible to minimize their influence on development of hot tears.

Design of the test casting is especially important since some shapes are such that their inherent cooling stresses coupled with localized hot spots would cause them to crack even if they were cast in a medium of perfect collapsibility. Initial test castings are cylinders of 1 in. and 6 in. inside diameters with a wall thickness of ½ in. The castings are 1 in. high and paired, one casting in a pair with a weak green sand core, the other with a strong dry sand core.

Castings are poured into a full ring riser to eliminate hot spots and any anchoring effect. Temperature measurements are taken during solidification and contraction with the hope of learning the temperature at which hot tears occur.

Tests to date indicate that with adequate feeding, no visual external hot tears will form using the hard core mixture. Internal examination of the castings, however shows a pronounced network of hot tears. Hindered contraction resistance of cores with varying density and hardness have been studied and other castings with varying diameters and wall thicknesses are under investigation.

Supervising the Steel Research Project at Armour Research Foundation, Chicago, is Charles Locke, director of foundry research. Personnel of the Steel Research Committee is: Clyde Wyman, Burnside Steel Foundry Co., Chicago, chairman; R. H. Frank, Bonney Floyd Co., Columbus, Ohio, vice-chairman; Charles Christopher, Continental Foundry & Machine Co., East Chicago, Ind.; George W. Johnson, Vanadium Corporation of America, Chicago; G. A. Lillieqvist, American Steel Foundries, East Chicago, Ind; and C. H. Lorig, Battelle Memorial Institute, Columbus, Ohio.

The Centrifugal Casting of Light Alloys Research

C. H. Wyman

C. E. Locke

Project was undertaken to study the possibility of commercial uses of this casting method. Successful application of centrifugal casting would increase considerably the metal yield, soundness and mechanical properties of light alloy castings.

The Centrifugal Committee decided to investigate primarily the centrifuging method, as more significant for commercial applications than true centrifugal casting, and to used sand molds, as the least expensive for experimental work as well as commercial founding. A detailed program for the preliminary stage of the project, on aluminum alloys, includes studies on sand mixtures, gating, pouring techniques, casting temperatures, spinning speeds, etc. Magnesium alloys will be investigated in the second phase of the work.

The Canadian Bureau of Mines is carrying out the whole investigation as part of its broad foundry research program for improving fabrication methods and promoting new applications of light alloys. A.F.S. provides the metal and sand for the project, all other expenses being borne by the Bureau.

Experimental work to date may be divided into three phases: 1. Adaptation and preparation of foundry equipment and measuring instruments; 2. Investigation of molding sand mixtures; 3. Study of effect of mold geometry. Considerable time has been spent on the design of special equipment and tools. Serious difficulties were encountered in finding a sand mixture

able to withstand metal penetration at high centrifugal speeds. Finally, a dry sand mixture was adopted and results have been fairly consistent and satisfactory.

The third phase of the investigation included a study of metal flow as affected by pouring method, design of pouring bowls, sprues and gating, venting, and similar factors. The low densities and high chemical reactivity of the light alloys, as well as the difficulty of separation of metal oxides of almost equal density as the metal, add considerably to the importance of smooth filling of the mold cavity. Casting experiments showed the difficulty of avoiding turbulence, splashing and gas entrapment in rapidly rotating molds.

Further experimental work will include a more systematic study of the basic characteristics of metal flow in small-scale centrifugal castings, proper gating design, and, if successful, production of full scale centrifuged castings for evaluation of their properties as compared with static castings of similar shape.

J. W. Meier, head of the non-ferrous research section of the Canadian Bureau of Mines, Ottawa, is superintending the research. D. Basch, Almin Limited of Great Britain, Schenectady, N. Y., is chairman of the Centrifugal Casting Committee; H. R. Youngkrantz, Apex Smelting Co., Chicago, is secretary. Others on the committee are: E. J. Basch, Doehler-Jarvis Corp., New York; Paul A. Beck, University of Notre Dame, Notre Dame, Ind.; W. S. Bingham, Centrifugal Machine & Engineering Co., Kalamazoo, Mich.; Walter Bonsack, Apex Smelting Co., Cleveland; Eugene M. Cramer, State College of Washington, Pullman, Wash.; R. F. Cramer, General Electric Co., Schenectady, N. Y.; A. Cristello, Bendix Aviation Corp., Teterboro, N. J.

J. W. Meier

D. Basch

J. C. DeHaven, Battelle Memorial Institute, Columbus, Ohio; J. A. Fulwider, Allison-Bedford Foundry, Bedford, Ind.; Nathan Janco, Centrifugal Casting Machine Co., Tulsa, Okla.; P. E. Kyle, Cornell University, Ithaca, N. Y.; O. R. J. Lee, British Non-Ferrous Metals Research Association, London, England; B. M. Loring, Naval Research Laboratory, Washington, D. C.; W. E. Mahin, Armour Research Foundation, Chicago; A. E. Martin, Precision Castings Co., Syracuse, N. Y.; J. W. Meier; R. A. Quadt, American Smelting & Refining Co., Barber, N. J.; H. J. Rowe, Aluminum Company of America, Pittsburgh; O. Tichy, Apex Smelting Co., Cleveland; and Sam Tour, Sam Tour & Co., Inc. N. Y.

The Malleable Research Project is intended to yield data on the most desirable microstructure for pearlitic malleable iron castings to be selectively hardened. Use of pearlitic malleable iron has increased rapidly during the past decade and the material has found extensive application in the automotive, agriculture, machinery, refrigeration and diesel engine fields. In many cases it has replaced important steel forgings and parts produced from bar stock and steel tubing. Cam shafts, rocker arms and various types of gears are a few of the parts which are being surface hardened.

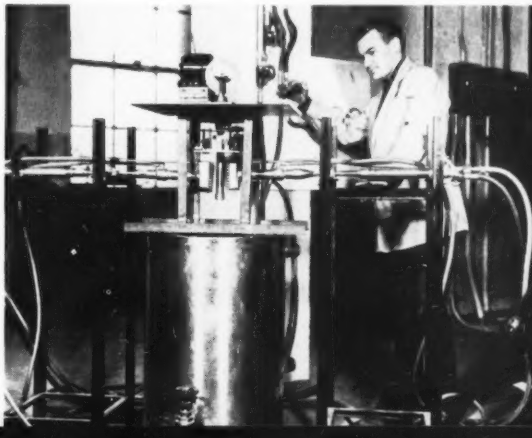
The investigation is being carried out on commercial malleable irons in current commercial use. Sources furnishing the test material cover a wide range of chemical composition, melting practice and heat treatment. Each source furnished approximately 100 bars in the white iron and in the heat treated condition. As cast the bars are $1\frac{3}{16}$ in. in diameter and 8 in. long. The heat treated bars are machined to 1 in. in diameter and surface hardened.

Hardening to date has been by the high frequency induction process and by oxy-acetylene flame. Varying times and rates of heating and other variables are under study, together with various quenching media. A complete study of hardness versus microstructure is being made on every possible combination of conditions.

Sufficient work has been completed to indicate the feasibility of the project. Final results are expected to be of considerable help to the malleable branch of the foundry industry and to the pearlitic malleable committees of ASTM and SAE. These groups are developing specifications for pearlitic malleable for localized hardening.

W. P. Wood of the University of Michigan, Ann Arbor, Mich., where the work is going on, is supervising the Malleable Research Project; S. H. Bush is research fellow. Members of the Malleable Research Committee are: Carl F. Joseph, General Motors Corp., Saginaw, Mich., chairman; W. D. McMillan, International Harvester Co., Chicago, vice-chairman; H. Bornstein, Deere & Co., Moline, Ill.; Roy D. Haworth, Jr., Armour Research Foundation, Chicago; W. A. Kennedy, Grinnell Co. Inc., Providence, R. I.; Carl F. Lauenstein, Link Belt Co., Indianapolis; R. Schneidewind,

Pearlitic malleable iron is flame hardened (below) and induction hardened on the Malleable Research Project studying best microstructure for surface hardening.



A simple fracture test being developed on the Brass and Bronze Research Project will indicate melt quality in induction furnaces (above) and all other furnaces.

University of Michigan; and Milton Tilley, National Malleable & Steel Castings Co., Cleveland.

Long range object of the Brass and Bronze Research Project is to relate the characteristics of the fracture of bronze to other properties of the metal. Work during the past year has been confined to a study of 85-5-5-5 brass and significant results can be reported. Visual examination and colored photographs of the fractures are included in the record of test data and melting is being done at different temperatures and under four atmospheres— oxidizing, neutral, reducing and the atmosphere of an induction furnace.

Tests so far indicate that tensile bar fracture can be correlated against bar density and the correlation is largely independent of furnace atmosphere or pouring temperature. Tensile bar densities can be correlated against fracture bar densities in 2 x 2 in., 1 x 2 in., ½ x 2 in. and 1 x 1 in. cross sections. Fractures of all but the latter follow the order for the tensile bars when arranged on a density basis with certain fracture characteristics standing out less sharply in the 2 x 1 in. bar than in the 2 x 2 in. or ½ x 2 in. bar.

Tensile bar fractures range from gray rim-salmon red center (low quality melts), through increasing rim with light brown center, to the disappearance of the rim and the appearance of a strong radial gray or reddish gray. The gray range in a bar with density in the upper 0.70's or lower 0.80's may break down to a definite rim and a gray or yellow-white center. Elongation will usually be low in this case while tensile strength may be over 35,000 psi. The same variations can be found in the fracture bars.

Microradiographs of 0.005-0.007 in. sections of the tensile bars provide a reasonably good confirmation of the melt quality. These are supplemented by photomicrographs of the same or closely adjacent sections.

The Brass and Bronze Research Project is conducted at the University of Michigan, Ann Arbor, Mich., under the direction of F. B. Rote. Research fellow is John Ewing. Heading the Brass and Bronze Research Committee is B. M. Loring, Naval Research Laboratory, Washington, D. C. Members of the committee are: Robert M. Brick, University of Pennsylvania, Philadelphia; George P. Halliwell, H. Kramer & Co., Chicago; Gordon J. LeBrasse, Federal Mogul Corp., Ann Arbor; C. A. Robeck, Gibson & Kirk Co., Baltimore, Md.; and A. J. Smith, Michigan State College.

Invitations to bid on the ninth A.F.S.-sponsored a research project—development of fundamental information on the gating and risering of cast iron—have been sent to a number of organizations. Sponsored by the Gray Iron Division, the initial project will require a review of current data and a compilation of abstracts of good practices; a study of available theoretical data and its reduction to practical usage; a registry of unsolved or borderline cases which point to the need for further work; and an outline of procedures intended to develop fundamental information on the gating and risering of gray iron castings.

The various bid proposals will be reviewed by members of the Gray Iron Research Committee, headed by J. S. Vanick, International Nickel Co., New York, with Alfred Boyles, U. S. Pipe & Foundry Co., Burlington, N. J., as vice-chairman. Other committee members are: T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.; B. F. Shepherd, Ingersoll-Rand Co., Phillipsburg, N. J.; and F. K. Vial, Griffin Wheel Co., Chicago.

C. F. Joseph

E. B. Rote

W. P. Wood

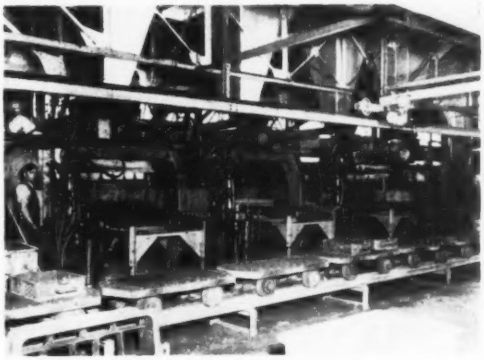
B. M. Loring

BELIEVED TO BE THE ONLY mechanized foundry in the world's motor car industry in which all castings necessary for production are made in the one industrial unit, the foundry of General Motors-Holdens Ltd., at Fishermen's Bend, Victoria, is an important unit in the production of the first all-Australian motor car, the Holden, recently produced.

General Motors-Holdens Ltd., spent $27,200,000 on the new car project, and the company has 8,300 employees in its various plants in the Australian capital cities of Melbourne, Sydney, Brisbane, Adelaide and Perth. The Fishermen's Bend plant occupies an area of 50 acres.

An initial outlay of $1,091,200 was necessary to establish the foundry. It produces gray iron castings, and a large part of the space is occupied with a conveyor system. Capacity of the foundry is approximately 30 tons a day, and sand consumption, 15 tons.

The range of products includes cylinder blocks and heads, manifolds, transmission housings, bodies and pistons for shock absorbers, and a wide variety of other items.



Completed mold halves move on roll conveyor from jolt-squeeze-strip molding machines to continuous conveyor.

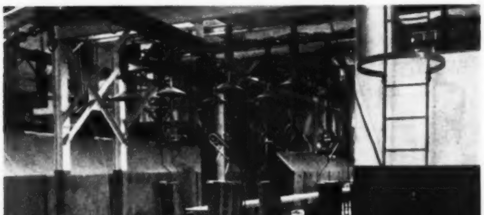
MECHANIZE AUSTRALIAN FOUNDRY TO RAISE AUTO CASTINGS OUTPUT

Complete mechanization in the handling of the sand is a notable feature. It is shaken out of the molding flasks, and taken by conveyor to overhead storage bins which feed it to sand mixing machines. Batches are elevated to overhead belt conveyors which feed the jolt-squeeze-strip molding machines. Completed mold sections move by roll conveyor toward the conveyor line and are tranferred by electric hoist.

Mechanical ramming has proved highly successful in eliminating defects like blowholes and oversized castings. The prescribed tolerances are very close.

Pouring is done while the molds are moving on the conveyor. Ladles are mechanized, and move from the electric furnace to the pouring station on an overhead monorail. From the pouring station to the shake-out, the conveyor is fully closed. Suction ducts remove any fumes at the pouring station.

Larger castings, such as cylinder blocks, are hooked to a pendulum conveyor at the shakeout, then pass to the shotblast booth at right for cleaning.



The core sand is oil-bonded, mechanically mixed, and moved to hoppers above the five core-blowing machines. Sand is blown into the box at an air pressure of 125 psi. Cores are vibrated out of the box on to the drying plate.

Average time of production of finished green cores, from box to drying plate, is approximately one minute. Daily potential is sufficient for 90 cars. The baking is performed in a vertical conveyor type oven.

Assembly, gaging and inspection of cores is carried out on an assembly line basis. In the case of major castings, such as cylinder blocks and heads, and also transmission cases, the core is set in the molds by the use of fixtures, and its position is then gaged. To facilitate handling all core boxes and plates are made from light alloy.

The foundry produces a nickel chromium alloy. Melting equipment includes two cupolas, used on alternate days, and an electric furnace for super-heating and refining. Uniformity is maintained by spot tests, supported by tests in the physical and chemical laboratory, which is an important part of the company's plant.

Other methods of materials handling include removal of large castings from the flasks by hooking them to the overhead monorail conveyor. Cores are shaken out on a vibrating shake-out, and the castings then move on through a shot blast booth.

Small castings drop into a chute beside the mold conveyor line, and the fall breaks the gates and risers from them.

Before leaving the foundry all types of castings are subjected to a close inspection.

MO-KAN, 40th A.F.S. CHAPTER, INSTALLED

Thomas F. Shadwick
Witte Engine Works
Chapter Reporter

THE MO-KAN CHAPTER of the American Foundrymen's Society was installed March 16 at Rockhurst College, Kansas City, Mo., when National Secretary-Treasurer Wm. W. Maloney passed the cast iron rattle symbolic of new chapterhood to Chapter Chairman J. T. Westwood, Blue Valley Foundry Co., Kansas City, Mo.

Made up of members of the Society representing the foundries in the Kansas City area of both Missouri and Kansas, the chapter was approved February 16 after going through an organizational period which started in the summer of 1948. Letter ballots returned since the February 16 meeting resulted in election of the

J. T. Westwood, Blue Valley Foundry Co., Kansas City, Mo., first Chairman of the Mo-Kan Chapter, receiving the cast iron rattle from National Secretary-Treasurer Wm. W. Maloney at the Chapter's installation.

following officers in addition to Mr. Westwood: Clarence W. Culbertson, M. W. Warren Coke Co., *Vice-Chairman;* Charles W. Myers, Jr., Morton-Myers Co., *Secretary;* and Herman P. Schwickrath, Prier Brass Mfg. Co., *Treasurer;* all of Kansas City, Mo.

Directors are: E. C. Austin, Jr., National Aluminum & Brass Foundry Inc., and Milton B. Gold, Gold Foundry & Machine Works, both of Independence, Mo.; Alan G. Linley, Locomotive Finished Material Co., Atchison, Kan.; W. Leslie Neville, Neville Foundry Co., Inc., North Kansas City, Mo.; and E. C. Sooy, Kansas City Hay Press Co., Kansas City, Mo.

Chapter reporter is Thomas F. Shadwick and chapter photographer is William Maness. Both are with Witte Engine Works Div. of Oil Well Supply Co., Kansas City, Mo.

In installing the new chapter, Secretary-Treasurer Maloney outlined the advantages of belonging to an active chapter of A.F.S. He related the background of the Society and told how the original group that met in 1896 decided that the association would be a technical organization. He outlined the educational program carried on in cooperation with schools and colleges, and in telling of the apprentice training program and the Annual A.F.S. Apprentice Contest recommended that the Mo-Kan Chapter get into all phases of the educational program. Mr. Maloney outlined the program of the coming A.F.S. Convention in St. Louis, May 2-5, and invited all members to attend.

Mr. Maloney stated that the backbone of any chapter lies in its officers and directors, and commended the steering committee for developing the Mo-Kan Chapter.

After installation Chapter Chairman Westwood accepted the gavel from Vice-Chairman Clarence W. Culbertson, who had been serving as chairman of the steering committee. Mr. Westwood stated that much good could be derived from a chapter in Kansas City, and pledged himself, with the help of all members, to do everything in his power to make the Mo-Kan Chapter a bigger and better organization.

The technical session was a talk and demonstration, *"Short Cuts in the Core Room,"* by Elmer E. Braun and David T. Martin, General Motors Corp., Danville, Ill. Mr. Braun, pointed out details of operation, poor equipment setups and methods of handling, as Mr. Martin demonstrated how better methods are accomplished through motion study and improvement of equipment.

Twelve cores were filed by hand and dipped by Mr. Martin, using the old method of working one core at a time. The job required 90 sec. By employing a simple inexpensive fixture, Mr. Martin worked two cores at a time, eliminating the hand file and completing the same operations in 47 seconds.

An old style core bench was set up with sand piled on top of the bench and with hand rammers, strike-off, core wires, and set-off table arranged haphazardly. Mr. Martin completed one plate of cores, from a small gang box containing four cores in 2.75 min. Extensions were added to the legs of the bench to raise it up so the workman could stand up straight. A sand hopper was added so sand could be loaded directly into the core box. Hand tools, wires, and set-off table were re-arranged conveniently for operator to eliminate extra movement. Mr. Martin completed the same number of cores with the remodeled equipment in 1.70 min.

Mr. Braun explained that the main purpose of their practical demonstration was to show how inexpensive simple changes can result in increased production with reduction of fatigue to the operator. A motion picture entitled *"Better Methods"* showed practices used before and after "better methods engineering" was employed in the General Motors foundries.

URGENTLY NEEDED!

VOLUME 48 (1940) TRANSACTIONS

Bound copies of this volume in good condition will be purchased by A. F. S. Headquarters. Members who have no further use for their copies are urged to write The Secretary, American Foundrymen's Society, 222 W. Adams, Chicago, 6.

Questions
THE ROUND TABLE
Answers

Broaden Technical Service of "Foundrymen's OWN Magazine"

PROVIDING SOUND TECHNICAL AND SHOP INFORMATION on a variety of problems, The Round Table has been a popular section of AMERICAN FOUNDRYMAN ever since it was started in July 1948. Sometimes giving a variety of opinions and facts on a single problem, this section of the magazine has also consisted of questions and answers of broad foundry interest.

Pictured on these three pages and listed below are the members of the various technical committees who will answer questions referred to them by AMERICAN FOUNDRYMAN. Answers will subsequently be published.

ALUMINUM AND MAGNESIUM DIVISION—D. L. Colwell, Apex Smelting Co., Chicago; Walter J. Klayer, Aluminum Industries, Inc., Cincinnati; Charles E. Nelson, Dow Chemical Co., Midland, Mich.; Walter E. Sicha, Aluminum Company of America, Cleveland; and O. Tichy, Apex Smelting Co., Cleveland.

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PATTERN DIVISION—J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn.; G. E. Garvey, City Pattern & Foundry Co., South Bend, Ind.; A. Huebner, Allis-Chalmers Mfg. Co., West Allis, Wis.; and V. J. Sedlon, Master Pattern Co., Cleveland.

SAND DIVISION—Bradley H. Booth, Carpenter Bros., Inc., Milwaukee; N. J. Dunbeck, Eastern Clay Products Co., Inc., Jackson, Ohio; and O. J. Myers, Werner G. Smith Co., Minneapolis.

STEEL DIVISION—Clyde B. Jenni, General Steel Castings Corp., Eddystone, Pa.; J. Edwin Johnson, Continental Foundry & Machine Co., East Chicago, Ind.; Walter W. Moore, Burnside Steel Co., Chicago; and D. C. Zuege, Sivyer Steel Casting Co., Milwaukee.

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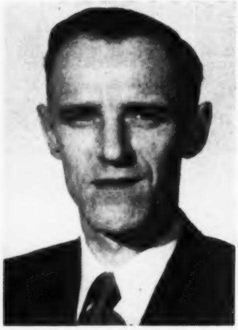

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Four New York State A.F.S. Chapters Plan Regional Foundry Conference

First New York State Regional Foundry Conference—to be sponsored by the Western New York, Eastern New York, Rochester and Central New York Chapters of A.F.S. in cooperation with Syracuse University—is scheduled for November 25 and 26 at the engineering and science campus of the university, Thompson Road, Syracuse, N. Y.

The tentative program includes technical sessions the morning and afternoon of November 25 and the morning of the 26th with luncheons both days and a dinner the evening of the first day. All technical sessions and the luncheons will be held on the Thompson Road engineering campus of the university and the dinner will be at the Onondaga Hotel, Syracuse.

A.F.S. members planning the New York State Regional Foundry Conference are (seated, left to right) E. E. Hook, General Conference Chairman, and a director of the Central New York Chapter and J. F. Livingston, Vice-Chairman, Central New York Chapter and Conference Secretary. Standing are Max T. Ganzauge, Rochester Chapter Chairman; Alexander C. Andrew, Eastern New York Chapter Chairman; and John R. Wark, Vice-Chairman, Western New York Chapter.

During the Conference the university's shops and laboratories will be open for inspection and will remain open after the final luncheon for those unable to visit them earlier.

General Chairman of the Conference is E. E. Hook, Dayton Oil Co., Syracuse. Secretary is J. F. Livingston, Crouse-Hinds Co., Syracuse; Wm. D. Dunn, Oberdorfer Foundries, Utica, is treasurer of the Conference. Conference leaders were named February 11 at a meeting of the directors of the Central New York Chapter following the suggestions of representatives of the participating chapters who met in Buffalo, January 15.

The organizational meeting for the New York State Regional Foundry Conference was held in Syracuse, March 19, with the following members of the participating chapters attending: *Eastern New York*—Alexander C. Andrew, American Locomotive Co., Schenectady; and J. Wheeler, Wheeler Brothers Brass Foundry, Troy. *Rochester*—Herbert G. Stellwagen, Hetzler Foundries, Inc.; J. F. Steeves, Corbett-Steeves Pattern Works; Max T. Ganzauge, General Railway Signal Co.; H. B. Hanley, American Laundry Machine Co.; and J. Hetzel. *Western New York*—John R. Wark, Queen City Sand & Supply Co., Buffalo. *Central New York*—From Syracuse, E. E. Hook, Dayton Oil Co.; E. G. White, J. F. Livingston, James O. Ochsner and J. A. Feola, all of Crouse-Hinds Co.; Frank C. Wheeler, Kinnman & Wheeler Co.; and Bruce R. Artz, Pangborn Corp.; from Geneva, L. D. Wright, U. S. Radiator Corp.; and from Utica, Wm. D. Dunn, Oberdorfer Foundries, and David Dudgeon, Jr., of the Utica Radiator Corporation.

Representing Syracuse University were Dr. B. J. Lazan and E. Syrene.

The organizational group approved the selection of Conference officers and appointed Mr. Wright chairman of the Program Committee and M. J. O'Brien, Jr., Symington Gould Corp., Depew, N. Y., vice-chairman.

Northern California Chapter Area Firms Give Castings History Book

Copies of Bruce L. Simpson's prize-winning book, Development of the Metal Castings Industry, published last fall by A.F.S. have been distributed to a number of schools and libraries in the San Francisco area by members of the Northern California Chapter. Recently named one of the 50 best books of 1948 in competition with over 10,000 publications of all types, the book is the result of several years intensive research and effort on the part of the author who is president of National Engineering Co., Chicago.

Following Mr. Simpson's tour of West Coast Chapters the Northern California group decided to distribute his book in connection with the Chapter's educational work. Recipients and donors of the volumes are:

Oakland Public School Department—2 books	Phoenix Iron Works Vulcan Foundry Co.
San Francisco Polytechnic High School	Columbia Steel Co.
San Francisco Public Library	Brumley-Donaldson Co.
Richmond High School	Atlas Foundry & Mfg. Co.
San Leandro High School and Castlemont High School	General Metals Corp.
Alameda High School	General Foundry Service Co.
University of California—2 books	Pacific Steel Casting Co.
Berkeley High School	H. C. Macaulay Foundry Co.
Stanford University	American Foundry Equipment Co.
Oakland Public Library	American Brass and Iron Foundry
Berkeley Public Library	Globe Metals Co.
University of San Francisco	Illinois Cereal Mills

The Northern California Chapter made book plates from its stationery and inserted one in each book to show the donor's name.

6 WAYS to MECHANIZE a FOUNDRY

Henry W. Zimnawoda
National Engineering Co.
Chicago

Increased production, reduced costs and better working conditions are the primary purposes of foundry mechanization. In developing the foundry mechanization program, not only must efficient molding machines, furnaces, and automatic cleaning equipment be considered, but first of all a carefully designed layout for the sand and mold handling system. Sand is the most voluminous material used in the foundry, and its efficient handling is a primary factor in decreasing manufacturing costs. The layout of sand handling units connected with specially designed auxiliary equipment will contribute to the technical improvements of production methods and secure trouble-free operation throughout the foundry.

A mechanized sand and mold handling system reduces considerably the operating volume of molding sand and number of flasks and bottom boards required. The overhead supply of prepared sand to the molding stations and continuous moving of molds relieves the molders of shoveling sand and carrying completed molds to the pouring floor. Moving molds on roller or mold conveyors and the continuous shakeout operation allows pouring shortly after closing the mold.

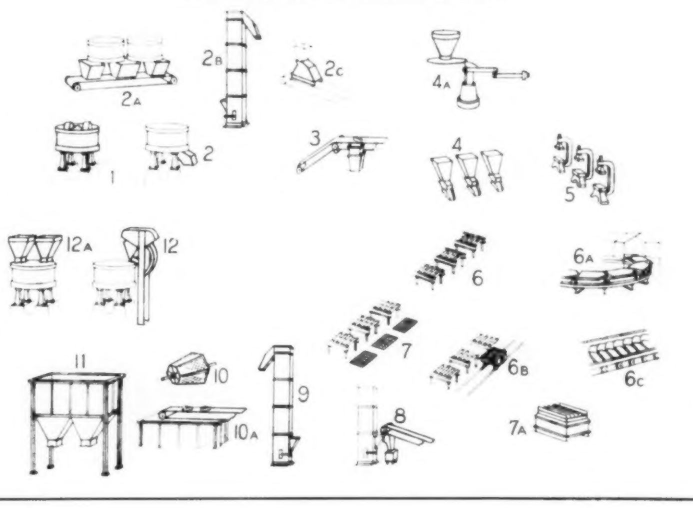
Conditioning of shakeout sand in proper mixers provides smooth casting surfaces and eliminates the occurrence of defects caused by non-uniform distribution of moisture and bonding materials. Minimum additions of new sand and bond are required, and the use of facing sand is eliminated in many cases.

The ability to shakeout molds during the day eliminates the hard and costly work of a night gang; moreover, it provides a regular flow of castings to the cleaning room. Due to the vibrating action of shakeout machines the castings lose most of the adhering sand, thus reducing the cost of cleaning operations.

In connection with sand handling equipment, an exhaust system can be arranged to arrest obnoxious fumes and dust at the places of origin. This will provide a clean atmosphere in the shop and increase operator efficiency.

These are the advantages of a mechanized system, each contributing to reduction in manufacturing costs

SAND AND MOLD HANDLING UNITS



Prepared Sand

1. Sand Mixer
2. Mixer Aerator
2A. Mill Belt Conveyor
2B. Prepared Sand Elevator
2C. System Aerator
3. Distributing Belt Conveyor
4. Molders' Hoppers
4A. Sandslinger

Molds

5. Molding Machines
6. Roller Conveyors
6A. Mold Conveyor
6B. Transfer Car
6C. Apron Conveyor
7. Shakeout Grates
7A. Vibrating Shakeout

Shakeout Sand

8. Magnetic Belt Conveyor
9. Shakeout Sand Elevator
10. Hexagonal Revolving Screen
10A. Bin Belt Conveyor
11. Sand Storage Bin
12. Bucket Loader
12A. Batch Hoppers

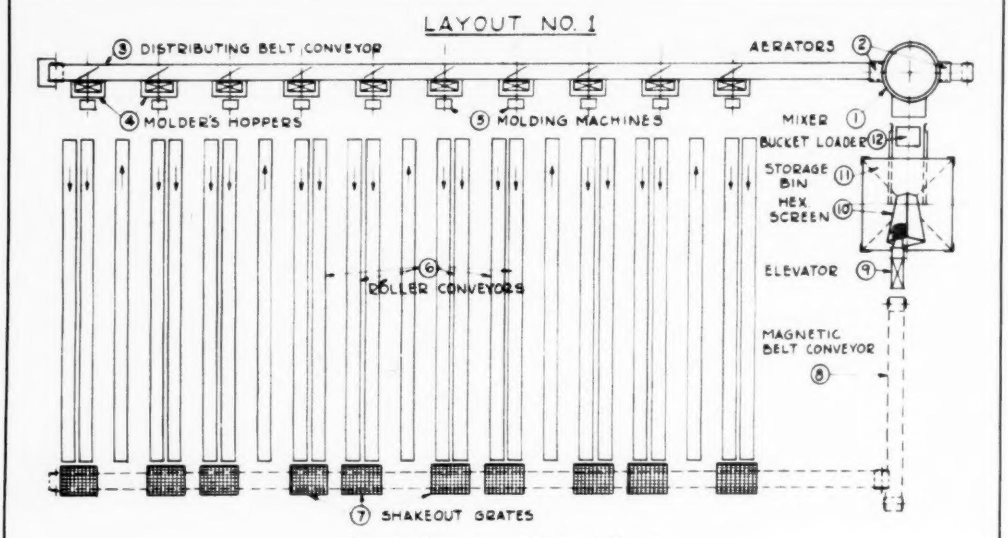


Fig. 1—Plan view of Layout No. 1.

and increased production of better castings. It is obvious that a competent study of the material flow and production requirement is necessary to arrive at the best solution of a mechanization problem; the function, operation and servicing of each unit must be considered and worked out if the system, as a whole, is to operate efficiently and economically.

The layouts shown in the paper are by no means new or exceptional. On the contrary, they are typical. They are the result of years of experience gained from successful operating installations and may serve as a recurring pattern to be changed or completed and profitably used in other modernization projects. These basic arrangements were selected with the idea of classifying them in the sequence of their progressive development.

Regardless of the type and size of the foundry, the modernization of production methods must be considered as a means for reduction of the pound price of castings produced. The purpose of this paper is to point out the way of approaching the problem of applying mechanized units and, by describing performance, insure selection of the proper layout.

Mechanization can proceed step by step with moderate capital investment for the initial unit. The savings obtained can be used to finance the next step, and in this manner the complete system can be built up gradually with minimum capital investment. During either normal or bad times a properly designed sand handling system is a distinct asset and a tool which will put the foundry in a strong competitive position for the future.

The principal units used in a sand and mold handling system are illustrated by sketches in the accompanying chart. The figures shown are marked with numbers referring to units in the several layouts described in the paper. The description of units is divided into three groups: (1) handling of prepared sand from the mixer to the molding stations; (2) handling molds from molding machine to the shakeout; and (3) handling used sand from the shakeout back to the mixer. (See chart on page 79.)

Layout No. 1 (Fig. 1) illustrates the simplest type of sand and mold handling system, consisting of 12 basic units. This layout lends itself to molding methods in tight or snap flasks of different sizes, allows latitude in core setting and permits selective pouring and cooling of molds. It represents a compact arrangement designed for continuous flow of sand and molds. The typical sand preparation arrangement applied in this system is shown in Fig. 2.

In this system completed molds are stored on roller conveyors, poured, cooled, and shaken out on grates. Flasks and bottom boards are returned on roller conveyor return lines. The shakeout sand is conveyed to the elevator by belts. The magnetic head pulley of the second belt cleans the sand of tramp metal, nails and wires. An elevator charges the sand into a hexagonal revolving screen which breaks the core and mold lumps, rejects non-magnetic impurities such as wood edges and other refuse, and passes the screened sand into the storage bin.

Continuous Sand System

The bin is designed with sufficient capacity to provide sand for continuous sand preparation in proportion to the storage of molds, and to allow the shakeout operation to be performed when most convenient. The gate of the bin and of the attached hopper are equipped with air cylinders, providing push-button charging of the bucket loader from the mixer platform.

During the mixing cycle of one batch the bucket

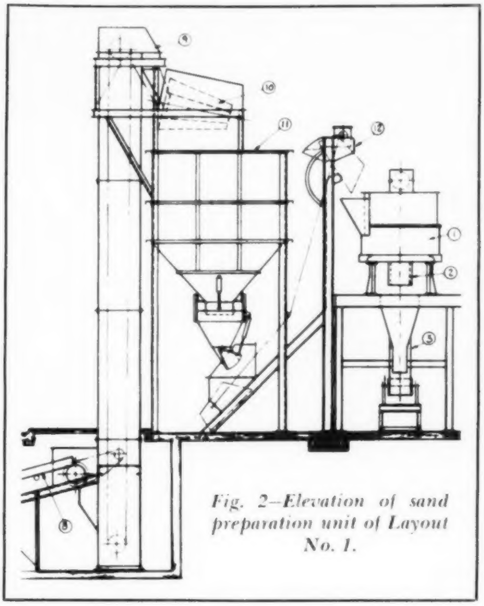


Fig. 2—Elevation of sand preparation unit of Layout No. 1.

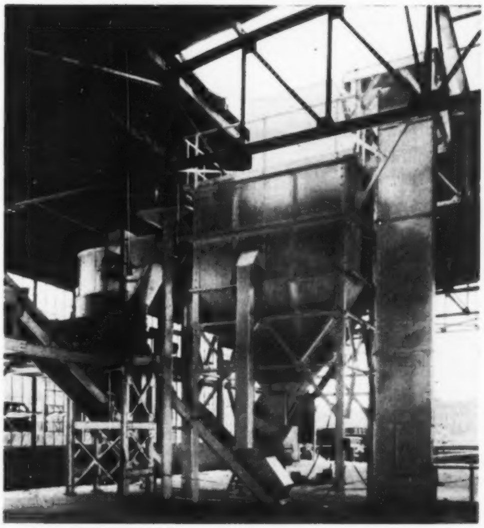
containing the next batch is raised to the position where it can be discharged into the mixer within a few seconds. In the meantime the gate of the storage bin is opened by action of the air cylinder and the hopper filled with the sand to be used in the next batch. This arrangement provides almost continuous operation of the mixer at full capacity.

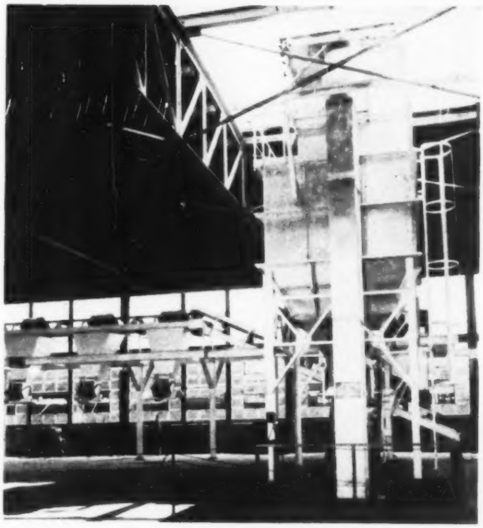
Prepared sand is discharged from the mixer through air-operated double doors, passed through two aerators into a mill hopper, from which it is delivered to a distributing belt conveyor and plowed off into the molder's hoppers. The single row of molding machines is supplied with properly prepared molding sand; waiting time for sand is eliminated; and the molders are relieved of the tedious job of shoveling sand. The length of roller conveyors controls the mold storage capacity of the system.

Initial Mechanization

This type of layout is applicable to any foundry having relatively small work and sufficient space for storage of molds. The arrangement comprises a minimum of equipment and is recommended for small- and medium-size foundries starting to mechanize. Figures 3, 4 and 5 are actual illustrations of sand preparation and handling equipment.

Layout No. 2 (Fig 6) is developed from the preceding one. The sand preparation arrangement is of the same type. The mold handling and shakeout system





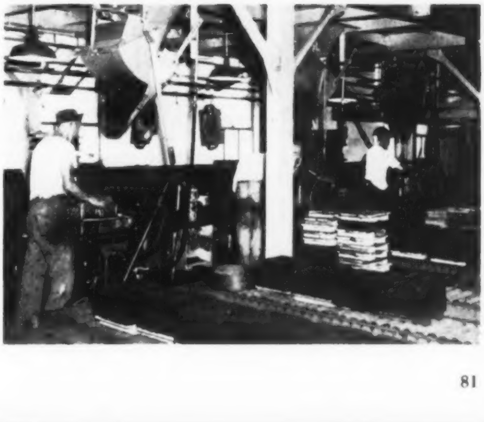


Fig. 3 (right, top)—Sand preparation arrangement of Layout No. 1 showing elevator, storage bin, bucket loader and mixer. Fig. 4 (right, center)—Part of sand handling system and sand preparation arrangement after erection and before start of operations. Fig. 5 (right)—Molding stations and conveyors of Layout No. 1.

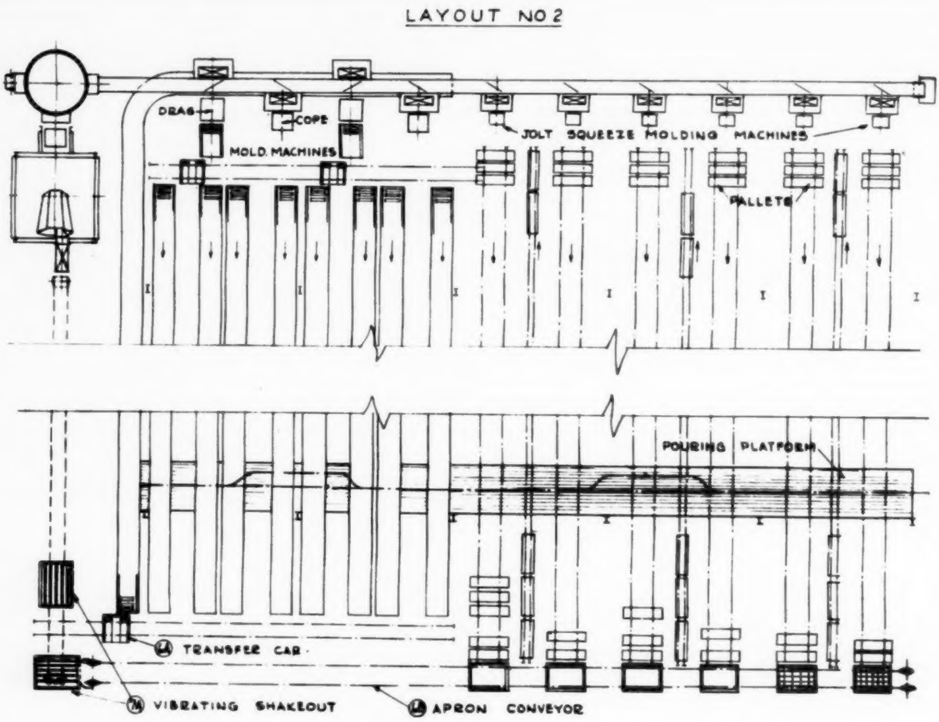


Fig. 6—Plan view of Layout No. 2.

is shown in two variations, and can be applied to suit different production methods.

The molds are made in tight flasks on two sets of cope and drag machines, and in snap flasks on six jolt squeezers. In the first section the drags made on roll-over machines are pushed onto short sections of roller conveyors for finishing and setting cores. The copes are made on pin-lift machines and brought over the drags for closing. Each completed mold is passed onto a transfer car and directed to the storage and pouring lines. The poured and cooled molds are transferred by another car to the vibrating shakeout. The layout sketch and Fig. 7 illustrate the procedure.

Molds Handled on Pallets

Snap-flask molds produced in the second section are stored and poured on pallets which take the place of the conventional roller conveyors. These pallets can be made of angle iron equipped with grooved casters running on tracks (Fig. 8), or as flat aluminum castings to be pushed on large spaced roller conveyors (Fig. 9). The empty pallets can be returned on tracks under the pouring lines or they can be stacked and returned on special return roller conveyors located between the pouring lines.

Referring to the chart of principal units, in this layout (Fig. 6) the shakeout grates (Unit No. 7) are replaced by the vibrating shakeouts (Unit No. 7A). Transfer cars (Unit No. 6B) and apron conveyor (Unit No. 6C) are the additional pieces of equipment for handling molds and castings.

The advantage of pallet arrangement consists of a close location of completed molds, thus allowing the use of almost the entire floor space for mold storage. This layout offers almost unlimited flexibility in mold production for intermittent or continuous pouring. The capacity of the sand preparation arrangement, the type of machines and the space for the mold storage can be adjusted to the required production output.

Layouts No. 1 and 2 described in the foregoing incorporate sand preparation systems consisting of one mixer with a bucket loader as the charging unit. The molds are handled on roller conveyors or pallets. The next two layouts will illustrate sand preparation arrangements with greater production capacity, consisting of two mixers with direct batch-hopper charging and additional equipment for sand conveying. The molds are moved on power mold conveyors of a continuous and semicontinuous type.

Layout No. 3 is illustrated in Fig. 10 and the pertaining sand preparation plant in Fig. 11. The molding machines are divided into two groups both located inside the mold conveyor loop. One group has four roll-over machines for production of drags, and the

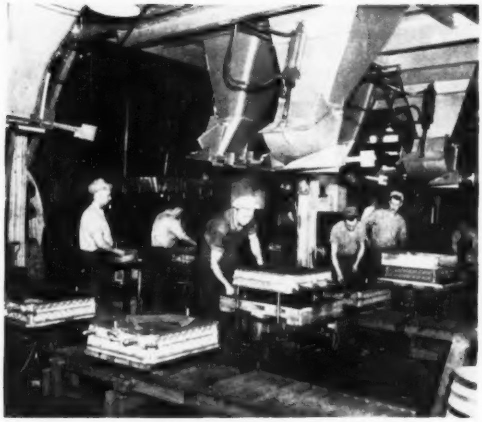


Fig. 7—Cope and drag molding stations with pin-lift and roll-over machines in first section of Layout No. 2.

other group has four pin-lift machines for the copes.

Referring to the chart of principal units, the mixer aerator (Unit No. 2) is replaced in Layout No. 3 (Figs. 10, 11) by three units operating in the following sequence: mill conveyor (Unit No. 2A); prepared sand elevator (Unit No. 2B); and system aerator (Unit No. 2C). The incorporation of these units is necessary in order to meet the requirement of larger sand volume prepared in two mixers. The bin belt conveyor (Unit No. 10A) is added for more economical filling of the larger size sand storage bin. The bucket loader (Unit No. 12) is replaced by batch hoppers (Unit No. 12A) suspended above the mixers. Figure 12 shows the inside of the mixer and two batch hoppers with air-operated gates.

It is worth mentioning at this point that there are two other methods of charging the sand mixer—the traveling weigh larry and the apron conveyor feeder (not marked on the chart). The traveling weigh larry is applied in cases where two or more kinds of sand are stored in the bin compartments; the apron feeder is used when a lower design of bin is required. The latter, however, does not permit as exact an amount of sand as compared with the volumetric batch hoppers, and requires more time to charge the mixer.

Minimum Floor Space Required

The sand preparation arrangement illustrated on the sketch is self-explanatory. Its vertical formation provides a saving of floor space, most economical use of supporting members, and allows the application of batch hoppers. Figure 13 shows the distributing end of this arrangement.

With reference to the chart of principal units, in Layout No. 3 the mold conveyor (Unit 6A) takes the place of roller conveyors (Unit No. 6). The mold conveyor moves in a counter-clockwise direction. It receives the drags from the group of roll-over molding machines. In transit to the closing point the cores are set from the outside of the loop, then the molds are completed in front of the cope machines. Production output of molding machines and the time required for core setting determines the speed of the conveyor. Length of pouring zone depends upon the required time for this operation and the number of men able to pour; the cooling time is controlled by the speed of the conveyor and the length of track between the pouring zone and shakeout station.

Sand from the shakeout passes through the grates of the vibrating deck into the hopper below. To allow gradual feeding of hot shakeout sand onto the magnetic belt conveyor, a vibrating feeder is installed under the hopper. This auxiliary piece of equipment is of great value in the sand handling system, especially when large surges of hot sand are passing through the shakeout. The trough of the feeder vibrates at high speed and its smooth surface offers no obstruction to rods or wires. Figure 14 shows the shakeout sand hopper, vibrating feeder and magnetic belt.

The described layout (Fig. 10) can be recommended

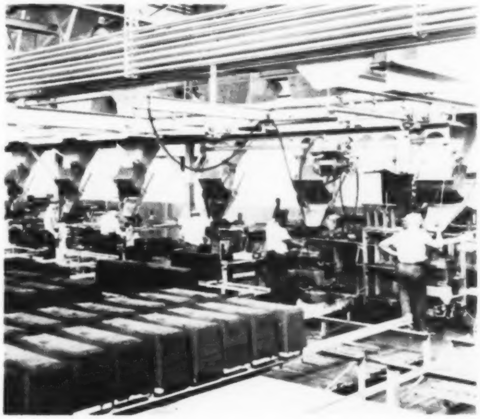
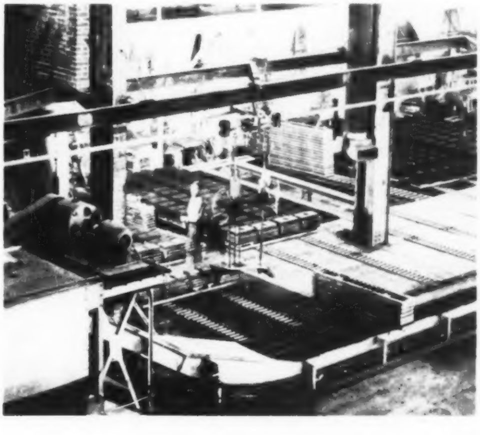


Fig. 8—Mold handling on pallets running on angle iron tracks. Pallets are returned under mold storage lines.

Fig. 9—Mold handling on pallets running on wide spaced roller conveyors. Note that the stacked pallets are returned on separate roller conveyors.



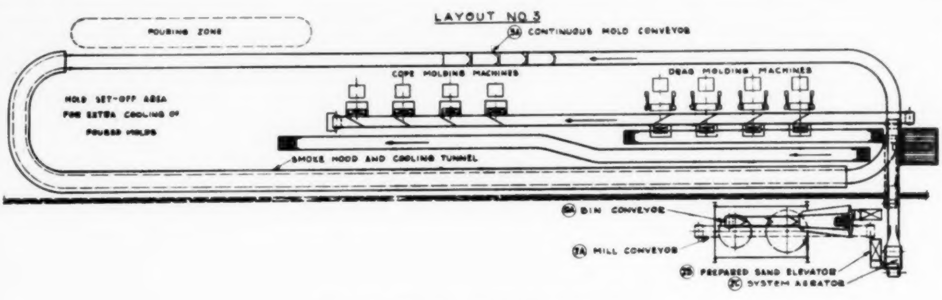


Fig. 10—Plan view of Layout No. 3.

for heavy cope and drag work, with a variation of mold sizes. A continuous delivery of hot metal is the basic requirement for the application of this type of layout. The melting rate of the furnace must be well balanced with the mold production and weights of castings. Experience indicates that a minimum requirement of 4 tons of metal per hour is necessary to justify the use of the mold conveyor. Figure 15 shows the mold conveyor, smoke hood and a side draft exhaust arrangement of the shakeout.

Layout No. 4 (Fig. 16) illustrates another type of mold conveyor serving 12 jolt squeezers operating with snap flasks. While the conveyor in Layout No. 3 (Fig. 10) operates continuously from one driving unit, this semicontinuous type consists of four separate trains, each of them driven by an electric motor located on the head car of each train.

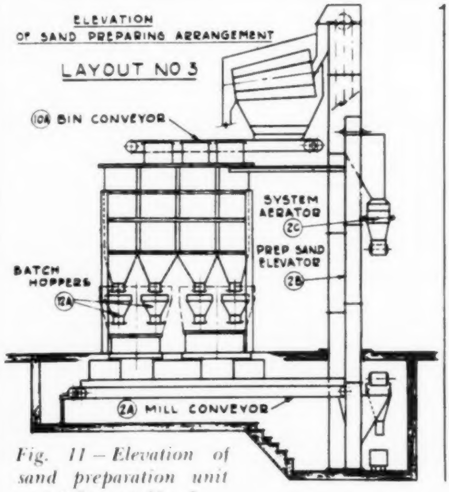


Fig. 11 – Elevation of sand preparation unit of Layout No. 3.

Variable Speed in Shakeout Zone

The mold conveyor loop is divided into molding, pouring, cooling, and shakeout zones. The first three zones are electrified and the trains in these zones are moved by the electric drive cars at a speed of approximately 120 fpm. In the shakeout zone the trains are cut off from electric current and driven by a variable speed caterpillar drive at a speed of 10-15 fpm.

During the time the train with cooled molds slowly passes the shakeout station, the remaining trains in molding, pouring and cooling zones are at rest. An established operating cycle can be set to meet the requirements of the slowest operation. During this cycle the molds are made and placed on the cars of one train, the jackets and weights are placed on the molds which are to be poured on the second train, the poured molds on the third train are cooled in the ventilated tunnel while the fourth train is moving slowly in front of the shakeout station. Figure 17 shows the pouring zone. On the right side one train is leaving and on the left side another is arriving. The head car with the electric motor is shown in the foreground. The jackets and weights are stored inside the loop.

Dumping of molds from the mold conveyor to the apron conveyor running in the pit is performed auto-

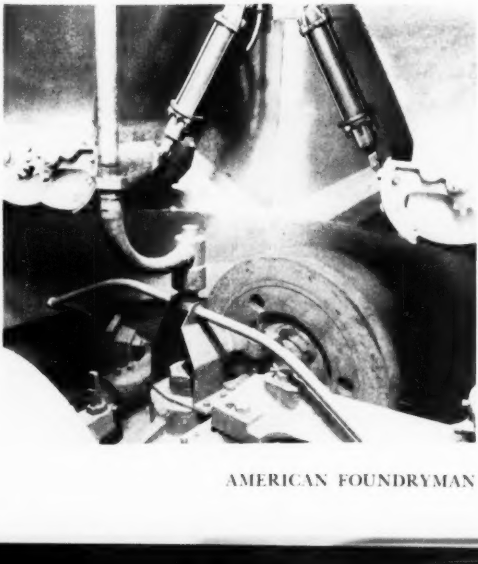


Fig. 12—Air operated batch hoppers suspended above the sand mixer and housed in a cooling hood.

matically. The carrying wheel contacts a limit switch, actuating the opening of the air valve to the air cylinder which tilts the hinged upper part of the tray into a discharging position. Several lugs provided on the top part retain the bottom board on the tray during the dumping operation. Figure 18 shows the air cylinder of the tilting device. The next train loaded with poured molds is visible in the same picture.

At the end of a predetermined time cycle the empty train with bottom boards on the trays arrives at high speed in front of the molding stations; the train with completed molds proceeds at the same speed into the pouring zone, and the train with poured molds enters the cooling tunnel and is directed by an automatic track switch onto the empty track.

The semicontinuous mold conveyor system is a refined development from the continuous mold conveyor. It provides longer cooling time and greater convenience in pouring. It is recommended for production requiring a variety of flask sizes as each molder's equipment is always returned on the same car, which stops immediately in front of his station.

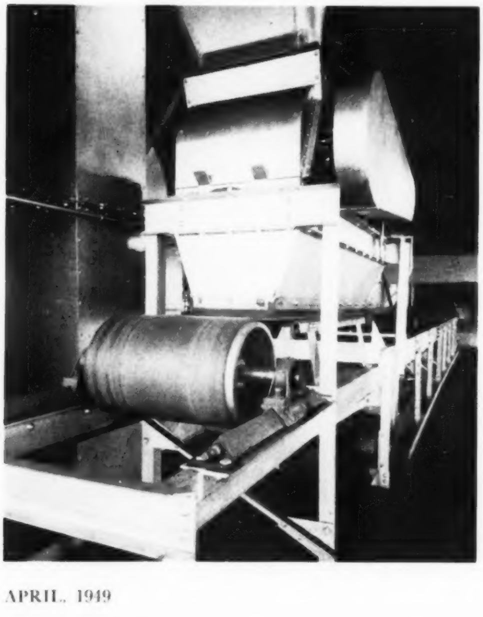
Having described two layouts with roller conveyors and two others with mold conveyors, we can now compare these two principal mold handling systems.

Roller Conveyor Arrangement

Advantages:

1. Handling of variable type molds.
2. Differential treatment of molds in regard to core setting and closing.
3. Flexibility in production through available space for mold storage, allowing intermittent pouring.
4. Possibility of selective pouring and cooling.
5. Separation of molding equipment used by each machine operator.

Fig. 13—Prepared sand is transferred from elevator through system aerator to distributing belt conveyor.



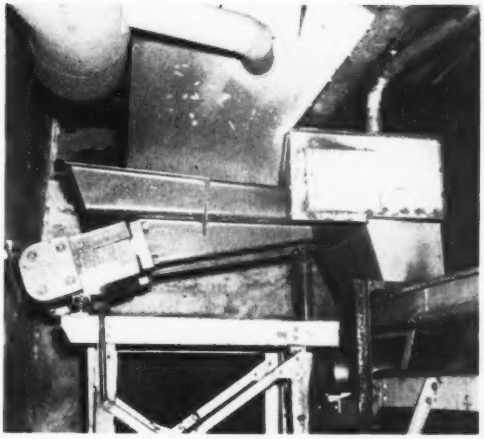


Fig. 14—Located in the pit under the shakeout is the sand hopper, vibrating feeder, transfer chute and the magnetic belt conveyor.

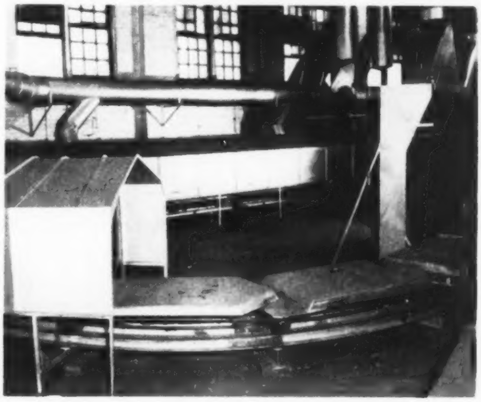


Fig. 15—View showing the mold conveyor, smoke hood and part of the exhaust arrangement for the shakeout.

Disadvantages:

1. Large floor space and large amount of molding equipment necessary.
2. Extra handling labor required for pushing molds and returning empty flasks and boards.
3. Long travel of pouring ladles.
4. Interference between hot metal distribution and shakeout operation.
5. Difficulty in exhaust system arrangement due to the large pouring area.

Continuous Mold Conveyor

Advantages:

1. Minimum floor space required.
2. Reduced amount of molding equipment.
3. Centralized pouring and shakeout convenient for exhaust arrangement.
4. Conveyor track can go around obstruction and take shape necessary to suit local floor conditions.

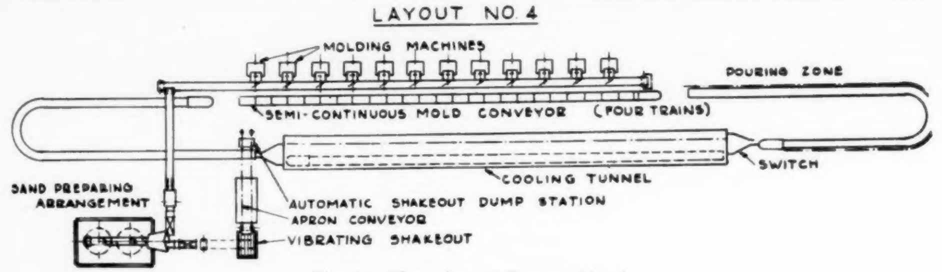


Fig. 16—Plan view of Layout No. 4.

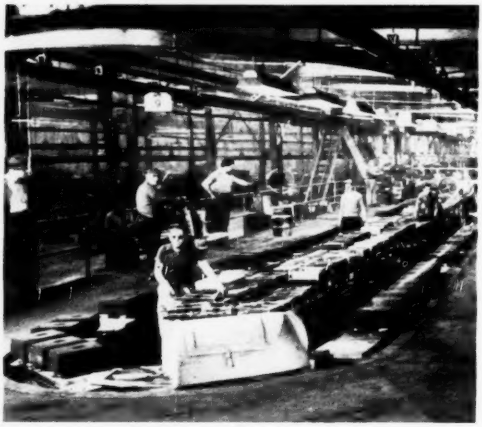


Fig. 17—Pouring zone view showing one mold conveyor train on the way to the mold cooling tunnel as another train arrives with molds to be poured.

5. Possibility of automatic shakeout arrangement in case of a snap flask molding system.

Disadvantages:

1. Requires the placing of molds on trays while conveyor is in motion.
2. Has limited flexibility in size of molds.
3. Requires continuous pouring and certain melting rate of furnace.
4. Molds must be poured while in motion.
5. Does not allow variation in cooling time.

Semicontinuous Mold Conveyor

Advantages:

1. Molds are placed on trays while the conveyor is stationary.
2. Different types of flasks may be used because the same tray always returns to the same machine operator.
3. Pouring takes place on the stationary conveyor.
4. Longer cooling time in a double track cooling tunnel.
5. Automatic shakeout possible for snap flask molds.

Disadvantages:

1. Initial cost higher than that of the respective continuous conveyor.
2. Requires approximately twice as much power due to the separate electric motor drive cars of each train.
3. More maintenance care required.

The foregoing list of benefits and drawbacks of each molding system gives a picture of the performance of the units and may assist in the choice of layout to suit the production requirements. The application of one of these systems or a combination of both will be dictated by the type and size of castings, kind of metal used, melting rate of the furnace, space available and amount of capital to be invested.

Repetitive Work Mechanized

Layout No. 5 (Fig. 19) represents a highly mechanized arrangement of sand and mold handling system, in which molding is done in tight flasks and pouring procedure and cooling time do not vary. It consists

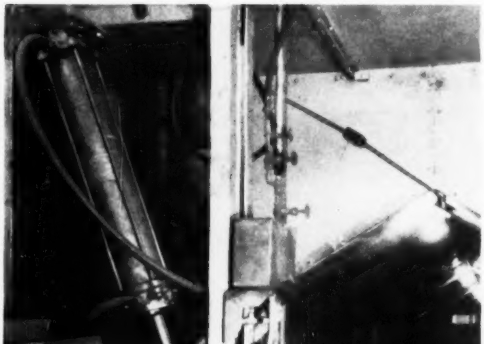


Fig. 18—Tilting device of the automatic dump station. Note the approaching train with poured molds.

of a sand preparation unit with two mixers and two sandslingers operating with drag and cope machines located on turntables.

Referring to the chart of principal units, note that molder's hoppers (Unit No. 4) are replaced by sandslingers (Unit No. 4A). The additional auxiliary units of the sand handling system, which are not marked on the chart, are the spill sand belt conveyors. These carry the sand from hoppers located under turntables to the mill conveyor running under the mixers. It can be seen from the layout that the mill conveyor is extended to both sides of the sand preparation plant. At one end it collects the sand from both spill sand belts; in the middle of its run it receives the prepared sand discharged from the mixers; and at the other end it delivers the mixture of both to the inclined belt conveyor.

Absence of the prepared sand elevator is one of the characteristic features of this layout. Some foundrymen, concerned with plugged elevator chutes, prefer the transportation of prepared sand by means of the inclined belts. Another interesting feature of this layout is the applied method of shakeout operation.

The poured molds, after being cooled under the smoke hood, arrive on the mold conveyor car in front of the first of two vibrating shakeout machines. Here the cope is lifted from the drag by means of a device suspended from an air cylinder. This air cylinder, movable on the monorail, is connected with another air cylinder attached lengthwise to the same monorail. By action of the second air cylinder the first cylinder with the attached cope is brought over the deck of the vibrating shakeout. Here the cope is lowered and released from the lifting device at the moment it contacts the vibrating deck of the shakeout machine. Figure 20 illustrates the operation.

The casting left in the drag moves along with the mold conveyor to the position between both shakeout stations where it is hooked by an air cylinder hoist and

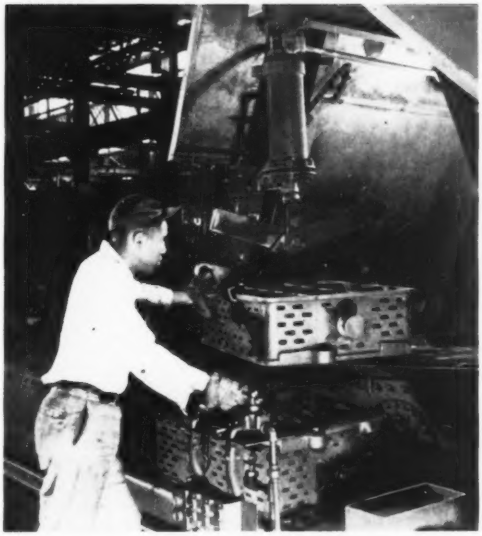


Fig. 20–Cope shakeout station. Note horizontal bar on upper part of the air cylinder lifting device which connects with the horizontal air cylinder (not visible) which is attached to the same monorail.

transferred to the overhead castings conveyor. When the drag arrives in front of the second shakeout, it is pushed from the mold conveyor car to the vibrating deck by the action of an automatic operating cylinder.

Another piece of equipment to be mentioned in this layout is the two-deck vibrating flat screen with two rows of roller crushers suspended above the upper deck. Its purpose is to crush the remaining core butts

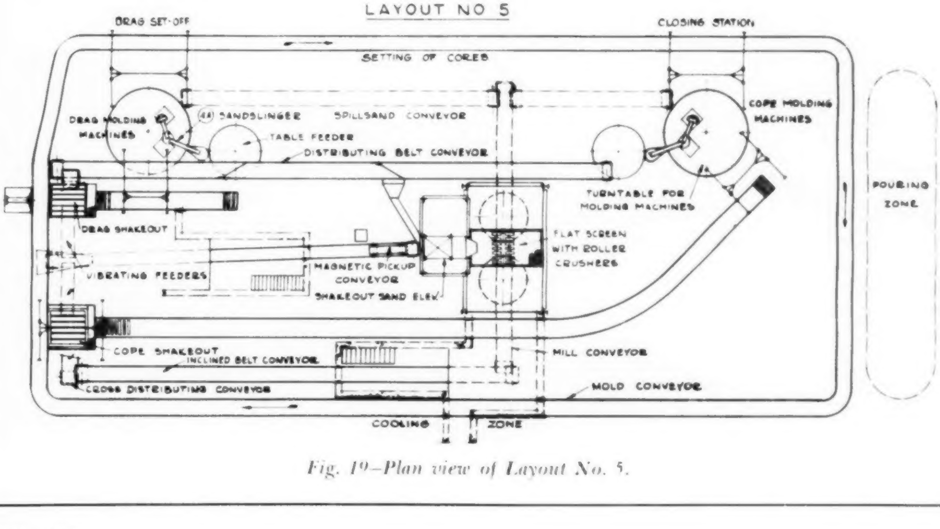


Fig. 19–Plan view of Layout No. 5.

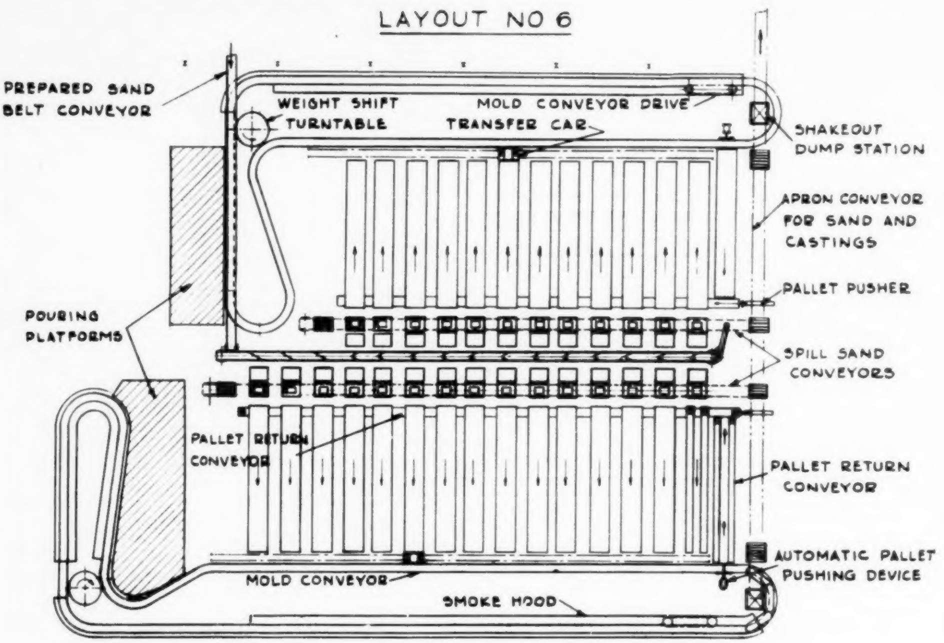


Fig. 21—Plan view of Layout No. 6.

Fig. 22—Transferring completed molds from roller conveyors to mold conveyor with roller-top trays. Note the two transfer cars.

Fig. 23—Weights are removed from poured molds by magnetic device, and transferred to the turntable.

and pass the sand through the screen. Crushing of lumps is done by the weight of loosely suspended heavy rings which individually raise and lower to allow the sliding of gaggers or wires on the inclined upper deck for disposal through the chute into the floor box.

In general, this layout represents the highest degree of mechanized system on the smallest floor space. The mechanical units for sand preparation and sand handling equipment and the return roller conveyors for empty flasks are located inside the loop. A quick circulation of sand, molds, and empty flasks; a controlled sand preparation and high efficiency of molding stations provides for the maximum production per man-hour and square foot of floor space.

Layout No. 6 (Fig. 21) illustrates a mechanized mold handling system which is a combination of roller conveyors and mold conveyors. The sand preparation plant located at a certain distance from the molding floor is similar to the design described in connection with Layout No. 3 (Fig. 10).

The prepared molding sand is transferred from a cross distributing conveyor to the main distributing conveyor and plowed off to the molders' hoppers suspended from the superstructure. The wide aisle between two lines of molding machines allows a convenient supply of cores, bottom boards and patterns. The spill sand grates under each molding machine and four clean-up grates over the apron conveyor maintain the cleanliness of the molding floor. Exhaust arrangements of the pouring and mold dumping stations insure a clean atmosphere in the shop and excellent working conditions for the molders.

In addition to the types of mechanical equipment previously described, this installation incorporates some additional refinement in handling molding equipment. Figure 22 shows that the molds are deposited on pallets, stored on roller conveyors and transferred by means of transfer cars to the mold conveyor while the conveyor is in motion.

After the pouring operation, the weights are removed from the poured molds by a magnetic lifting device suspended on an air cylinder and movable on a short monorail track. This device (Fig. 23) is equipped with a rectangular magnet which is energized by closing a contact attached to one of two handles.

The contact on the other handle, through the action of a solenoid valve and air cylinder, allows the operator to raise the device with the attached mold weight. By a short movement forward, the device is brought over the revolving table (marked on the layout sketch in Fig. 21), lowered and released by the de-energized magnet. Another operator standing on the opposite side of the turntable transfers the weights to the molds about to enter the pouring zone.

Another interesting item of this arrangement is the handling of mold pallets. After the mold dumping operation is performed the empty pallets are pushed from the mold conveyor to the roller conveyor return line by an automatically operated air cylinder (Fig. 24). The pallets are then piled and transferred to another roller conveyor running lengthwise to the molding stations under the main roller conveyors. Figure 25 shows how, by the action of the air-cylinder pusher, the pallets are returned to the molding stations.

In general, this installation combines the benefits

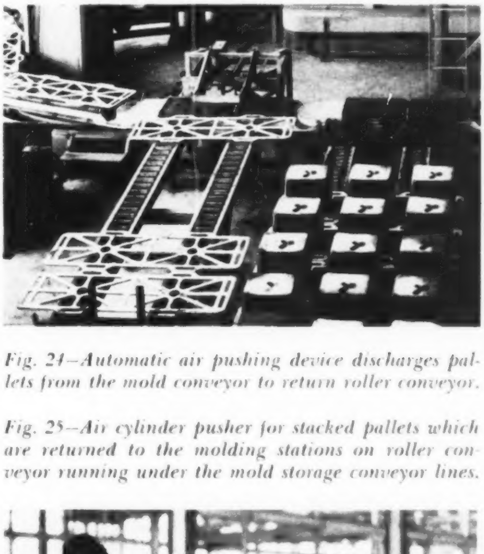
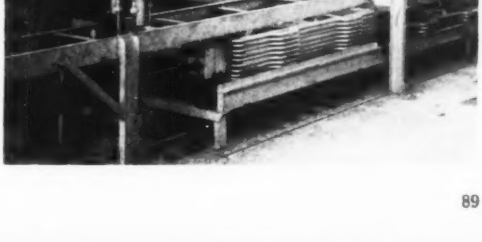


Fig. 24—Automatic air pushing device discharges pallets from the mold conveyor to return roller conveyor.

Fig. 25—Air cylinder pusher for stacked pallets which are returned to the molding stations on roller conveyor running under the mold storage conveyor lines.



of roller and mold conveyor units. The storage of molds allows selective transfer of molds to the mold conveyor to be continuously poured with different types of metal if required. Either the one- or two-loop conveyor system lends itself to any foundry having a high production of relatively small work.

Conclusion

While the foregoing descriptions of typical layouts are sufficiently complete to allow the proper orientation, it must be remembered that in the analysis of the mechanization project it is not enough to compute the increase in mold production and savings in direct labor and materials. To justify the investment in mechanical equipment, reliable manufacturing costs of the old system must be compared with estimated savings and expenses for additional maintenance, operation of units, depreciation of equipment, and interest on capital involved in the new system. Such a comparison will show whether the layout and equipment have been properly selected.

In order to obtain maximum returns from the mechanized system, all patterns, core boxes and flasks must be checked periodically to avoid interruptions in production. A daily production schedule must be prepared in order to synchronize the operations of core room, molding floor and cleaning department and balance the molds produced with the melting rate of the furnace. Conscientious maintenance personnel must care for the equipment and keep the necessary spare parts on hand.

The management of the foundry must be able to adjust the production program to the capacity of the installation without bottlenecks or overloading of units. The prepared schedule must be sufficiently flexible to allow immediate changes when necessary, without waste of time or idle run of units.

Generally speaking, with the exception of very small foundries, the mechanization project should be started simultaneously in all main sections of the foundry. Rapidly increasing mold output due to the use of the overhead sand supply and mold conveying system may be slowed down by the inefficiency of core delivery or congestion in the cleaning room. Assuming that the supply of molding sand and hot metal distribution will meet the requirements, the capacities of the auxiliary sections must still be checked and adjusted to the increased production of molding floor.

No phase of foundry operation can be omitted in the preparation of the proper sand and mold handling layout, and the close cooperation between the foundry management and foundry equipment engineering office in the early stages of the mechanization project is of great importance. Detailed analysis of the production requirements will eliminate unnecessary adjustments and secure the full efficiency of the system.

Need Ferrous Bearing Design Data

Little factual design data exist to help the designer in selecting cast iron or steel for bearings according to the article "Plain Sleeve Bearings," *Product Engineering*, October 1948, pages 129-159. In most new applications, past performance of bearings under comparable conditions is used as a design criterion

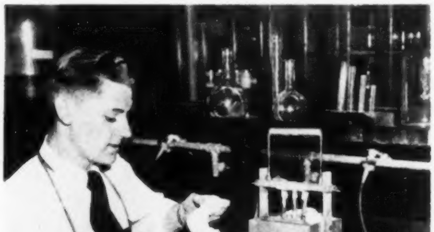
"Cast iron bearings are not run at speeds greater than 130 fpm or unit pressures greater than 500 psi. Lubrication must be better and bearing clearances larger than for most other bearing materials. This is done to avoid scoring if hard particles from the cast iron should be torn loose and ride between the bearing and journal. The general rule is 0.0015 to 0.0020 in. clearance per in. diameter of the journal. Journals can be made of soft steel with a Brinell hardness from 150-250, preferably nearer 250. Smoothness of journal and bearing are important bearing life factors. Journals are usually ground and polished; bearings are diamond bored. The maximum operating temperature is about 150 F.

"Steel bearings gall quickly with poor lubrication. Galling can be controlled to some extent by using dissimilar steels for bearing and journal. Nickel steels are used for steel bearings. SAE 2312-2315 have been used with some success.

"Steel bearings require very smooth surfaces to reduce galling tendencies. For most applications they are designed to operate at low loads and at speeds not over 150 fpm. Because of their poor performance when inadequately lubricated, the operating temperature should not be more than 125 F. Steel bearings should be used to support shafts operating with intermittent motion rather than continuous motion."

Model Cell Reduces Alumina

This working model of Charles Martin Hall's original reduction cell, shown with its creator, Stanley Sitta, a student at Morton High School, Cicero, Ill., is capable of producing small buttons of pure aluminum from standard materials used in commercial reduction—alumina, cryolite and metallic fluorides. Operated by a 500 ampere, arc-welding generator, the model requires 5-7 hours to produce pure aluminum. Mr. Sitta's model cell won top honors in the Chemistry Division at the recent Illinois State Science Exhibit, and a certificate for the best model exhibted. The youthful scientist is a member of the Illinois Junior Academy of Science, an organization of science-minded high school students.



DESIGN LIGHT METAL CASTINGS

Responsibilities of Metal Producers, Foundries, and Designers

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One of the important responsibilities of all who are engaged in the engineering considerations or in the supply of aluminum or magnesium foundry products is to recognize the *principle* on which the majority of light metals usages is predicated and to see that all operations and practices in designing and creating the foundry product conform to this principle. This principle upon which the use of light alloy castings has been established is the desire to obtain maximum structural efficiency, that is, maximum performance with minimum weight, and for a cost lower than this improved performance could be obtained by any other means.

It is quite evident that merely using the light alloys without close attention to obtaining the fullest structural efficiency possible may not be adequate to bring about any improvement in structural efficiency over designs in the heavier metals. Indeed, it may even result in a step backward to lower structural efficiency or malfunctioning of a part formerly satisfactory in a heavier metal. A large market is developing for light metal castings where they qualify for certain uses solely on the basis of lowest cost. For this type of use, structural efficiency is not of paramount concern but, nevertheless, is important for obtaining minimum casting cost.

It is the responsibility of the Design and Stress Analysis Committee of the Aluminum and Magnesium Division of A.F.S. to recognize and assist in remedying the problems concerned with achieving maximum structural efficiency from magnesium and aluminum foundry products. To this end, the committee is promoting activities devoted to providing information about the relationship between design, choice of materials, their laboratory properties and serviceability.

Service Data Needed

Extensive information about stress analysis techniques, metal strength data, and the effect of foundry variables on metal strength and serviceability are necessary for understanding this relationship. Interrelating these subjects will clarify the respective responsibilities of the foundrymen, designers, and foundry products users, and will lead to a fuller appreciation of light metal foundry products.

Although the problems with respect to designing in either aluminum and magnesium are somewhat similar, the analysis of the general design problem and the assistance available for solving it will be reviewed here with special attention to magnesium casting alloys.

Two reasons account for singling out magnesium. Aluminum foundry products have enjoyed longer and more diversified field service than have magnesium products. Accordingly, successful aluminum design practices have been evolved in larger part from service experience than has been possible for magnesium. Magnesium casting design, on the other hand, must depend more on information acquired by analytical laboratory work of a type which must be complemented with stress analysis and forecasting studies.

In this regard, then, more specialized designing techniques and the analyses of the effects of foundry variables are necessary for magnesium. These same techniques, it should be noted, will assist also in design problems in other metals. The second reason for special reference to magnesium is the closer familiarity of the writer with the magnesium rather than the aluminum industry.

Thanks in large part to the efforts of magnesium foundrymen throughout the country, we are now in a particularly favorable position to supply complete and precise design information for designers and users of magnesium foundry products. In order to present this information more effectively, however, it is necessary to outline specifically what the general design problem is in this connection and then to review what has been done about it.

Designers' Problems

When light alloy castings are to be used, the designer must either start with a completely new design, as is usually the case for aircraft components, or on the basis of the previous design in another metal for which the light alloy casting is to be substituted. The latter is frequently the case for commercial uses. The stepwise procedure followed for either approach is outlined in Table 1.

These procedures preclude the use of the ordinary cut-and-try methods since such methods offer little chance of arriving in a short time at a design of high structural efficiency which even approximates that evolved by the procedure outlined in Table 1 and to be described in this paper. Cut-and-try methods are becoming obsolete in proportion as the demands for higher structural efficiency become more intense, and as the facilities for stress analysis and the availability of metal strength data for use in predicting service improve.

Structural uses for which the designer must develop a new design usually involve complex design requirements where loading and other experiences defy predictability. In this case the prototype casting is made based on matching theoretical loading requirements against the known safe static, fatigue, impact, and creep strength property values given for the metal.

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Table I – Design Procedures

I. Developing a New Design—Sequence of Steps for Establishing Final Design

- (a) Theoretical determination of loads
- (b) Matching above loads against known metal strength information to establish initial design
- (c) Creation of prototype casting
- (d) Static and dynamic experimental stress analysis during service or simulated service loading
- (e) Matching results of stress analysis against known metal strength information to establish final design
- (f) Creation of casting to final design
- (g) Final proof testing

II. Developing a Substitution Design—Sequence of Steps for Establishing Final Design

- (a) Assumption that design in former metal is adequate—or revisions to allow for structural inadequacies or changes in fabrication procedure
- (b) Matching sections of previous metal with proposed light metal designs, taking into account known metal strength information for *both* previous metal and proposed light metal to establish initial design
- (c) Same as (c) above
- (d) Same as (d) above
- (e) Same as (e) above
- (f) Same as (f) above
- (g) Same as (g) above

These steps may eventually be excluded when experience with the procedure in (a) and (b) is perfected and when strength data in (b) become adequate for forecasting serviceability for all structural metals.

Here we are immediately confronted with two problems. The first is the inadequacy of the method of theoretical prediction of service loading requirements. The accuracy of theoretical design analysis for predicting service conditions in castings where complicated loading is involved is inadequate because such calculations usually must be predicted on simple static loading, and do not properly consider complex dynamic loading, fatigue and impact problems and stress concentrations that may be critical regardless of the thickness of wall sections, or other design details in the immediate proximity of the stress raisers. Theoretical calculations, consequently, serve only as a starting point in the design project.

The second problem is the scarcity of complete strength properties, particularly fatigue, impact, and creep, and instructions for predicting serviceability from these for the various metals considered. The only strength data that can be used are those which involve, to the proper degree, the foundry and other practical variables that are likely to be present.

These variables include the effects of porosity, grain size, perfection of heat treatment, surface smoothness (as cast surfaces vs. machined surfaces) and stress concentration. If these data are available and experience has been obtained to demonstrate how the data can be used directly for design purposes, the data can be used with confidence, thus enabling the first design to be established as closely as the accuracy of the theoretical calculations allow.

Developing a Substitution Design

In the case where aluminum or magnesium castings are to be substituted for castings of other materials, the necessity for complete strength data again becomes apparent. Although it is often advisable to develop a new design from the beginning, predicated on light metal practices, an alternative starting point for designing in this case is to use the design in the metal previously employed. If it is assumed that the period of service use of the part in the previous metal resulted in the evolution of a successful design in the previous material, the problem is then simplified for the designer.

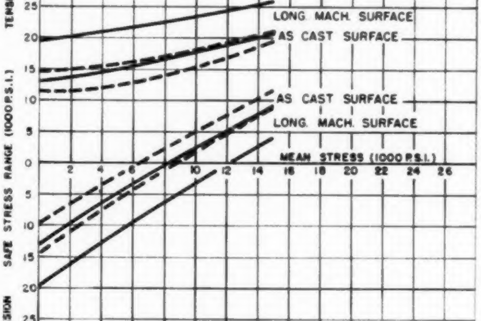
In this case, he must merely substitute magnesium or aluminum, taking into consideration the respective strength properties of the previous and the proposed new metal. Essential for this procedure is complete strength information for the previously used material. This, however, is not nearly as complete as the information available describing the light metals and frequently becomes another problem in simple substitution techniques.

If it is known that the part to be substituted in light metal alloys is not adequately designed, alterations can be planned at this time based on the previous service information on the part. Frequently certain features of the previous design were necessary to enable given fabrication methods to be employed. Such would be the case where pressed or formed steel parts are involved.

When a casting is designed to replace a formed steel part, sections should be changed to accommodate the casting process. Certain section thicknesses and design details were incorporated in the previous design only to facilitate forming and should be identified and altered to favor the casting process and structural efficiency requirements.

After the initial design is established based on theoretical load calculations or material substitution criteria involving accurate material strength data, an initial casting is made. The efficiency of this first design is then evaluated by experimental stress checks. Metal strength data, if available and sufficiently ex-

Fig. 1—Plate bending fatigue, magnesium alloy sand castings, 10^5 cycles. Consolidated information expressed in bands for machined and cast surfaces of commercial magnesium alloys under alternating bending loads.



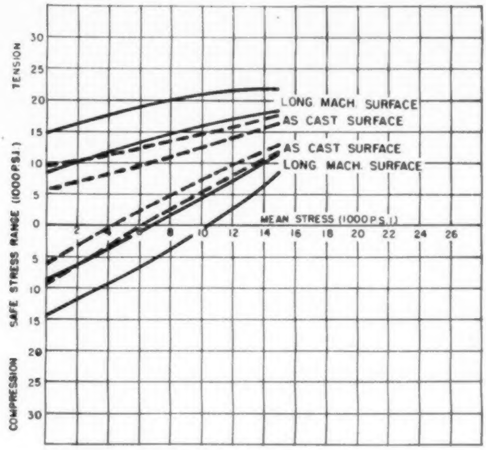


Fig. 2–Plate bending fatigue, magnesium alloy sand castings, 10^7 cycles (see Fig. 1).

tensive, are again used for comparison with stresses measured in the experimental stress analysis.

On the basis of this comparison, superfluous metal can be removed where working stresses are judged to be far below the critical strength values for the metal, or metal added where stresses are above or too close to the critical strength values. A new, and perhaps final, casting design is then made.

Useful Design Data for Castings Necessary

In these design operations, whether for a completely new design or material substitution project, complete quantitatively useful static, fatigue, impact, and creep strength information about the metals concerned is necessary.

Despite the abundance of tables describing the strength properties of metals, there is an acute shortage of data directly useful to designers for describing metal strength under variations in loading, design and casting quality. This is explainable since it is only recently that design analysis methods have become sufficiently accurate to require precise descriptions of how materials would behave under these various conditions.

Some designers such as W. T. Bean, Jr.[1] and Young and Slachta[2] have used strength property information obtained mainly from their own experiences with castings, plus a limited additional amount of information supplied by the basic metal industries. These data have been incomplete and the validity of using these values directly in design problems has usually been independently justified by each designer. The resultant data has been incomplete and not generally available.

We now have much more complete data determined by laboratory testing procedures which take into account practical variables. How to use these data for direct design where a question existed regarding this point has been determined by service and simulated service tests. These data for cast magnesium alloys are briefly reviewed in this paper.

As previously described, the design data required for castings are those which accurately define metal strengths under all conditions of loading and for all variables which define casting quality within the commercial range of these variables.

The various conditions of loading include: steady applied loads (creep stresses), infrequent gradual applications of load (static stresses), infrequent rapid applications of load (impact stresses), and repeated applications of load (dynamic or fatigue stresses).

Magnesium Design Data Available

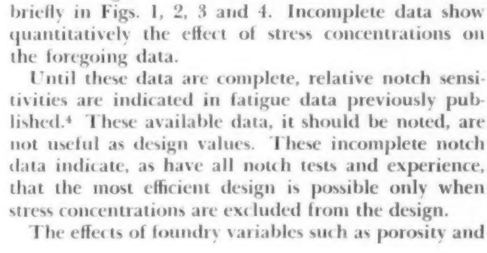
Because light metal alloys are generally used in moving parts, dynamic stresses have proved to be the most frequently critical of the types listed for determining serviceability. Accordingly, design data for fatigue requirements involving (*a*) at the various modes of load application (bending and axial), (*b*) various combinations of static preload and superimposed dynamic stress (since simple reversed stresses are rarely found), (*c*) various surfaces (as cast and machined), (*d*) various degrees of stress concentration, (*e*) porosity, (*f*) residual stress, and (*g*) grain size must be made available.

Complete fatigue data for magnesium casting alloys to satisfy (*a*), (*b*), and (*c*) are now available. These data have been observed in extensive field and simulated field tests described elsewhere to be adequate for use as design values[1]. These data are summarized briefly in Figs. 1, 2, 3 and 4. Incomplete data show quantitatively the effect of stress concentrations on the foregoing data.

Until these data are complete, relative notch sensitivities are indicated in fatigue data previously published.[4] These available data, it should be noted, are not useful as design values. These incomplete notch data indicate, as have all notch tests and experience, that the most efficient design is possible only when stress concentrations are excluded from the design.

The effects of foundry variables such as porosity and

Fig. 3–Axial fatigue, magnesium alloy sand castings, 10^7 cycles. Same as Fig. 2 for axial fatigue tests.



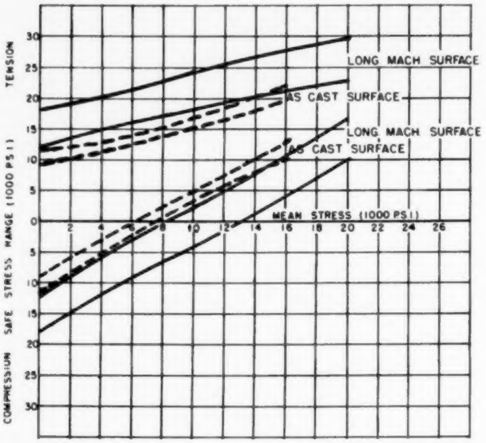
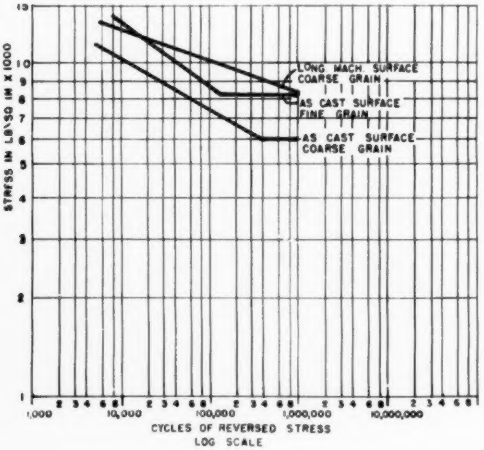


Fig. 4—Magnesium alloy sand castings, axial fatigue, 10^7 cycles. Same as Fig. 2 for axial fatigue tests.

residual stresses on fatigue properties have been described elsewhere[3,5]. Briefly, subsurface porosity has no observed effect on fatigue properties. Porosity which intersects the surface is detrimental to fatigue properties. Residual stresses have been measured by a technique developed for magnesium. This technique allows the residual stresses created by the measuring operation itself to be distinguished from the residual stresses locked in during foundry operations.

Residual stresses in magnesium castings of commercial alloy and heat treatment are so low as to have no significant effect on serviceability. The effect of grain size on fatigue properties is shown in Fig. 5. It will be noted that the condition of surface finish has a greater influence on fatigue properties than grain size variations with the range found in commercial castings. To

Fig. 5—Effect of grain size on fatigue strength of heat treated sand cast magnesium panels.



the best information of the author and his associates there have been no service failures in magnesium castings that could be associated with grain size.

Data describing the static design properties and other characteristics of the cast magnesium alloys are available in the literature[6,7]. The effects of porosity and grain size are described[8,9,10]. Design values for creep and impact loading also can be obtained from available literature[11,12]. The effect of grain size on

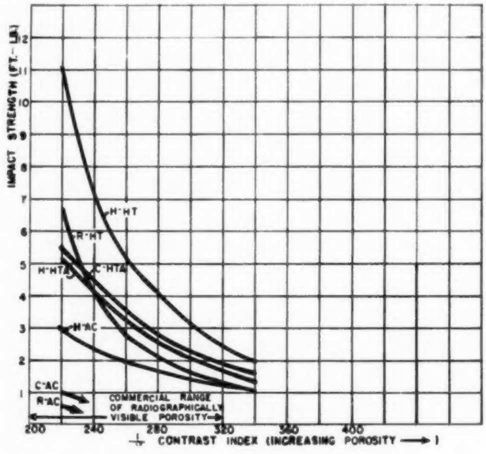


Fig. 6—Effects of porosity on impact strengths of magnesium alloys. Charpy plain bar impact test.

impact strength is known[9]. The effect of porosity on impact is shown for a number of alloys in Fig. 6.

Summary

Reviewing the steps necessary for attaining an efficient casting design reveals the problems facing designers and foundrymen alike in their efforts to promote efficient design practices.

Once these problems are recognized, it is not difficult to determine who is responsible for remedying them.

It should be the responsibility of the basic metals industries to provide both the basic metal strength information and a means for predicting serviceability from this information which takes into account practical variables.

The responsibilities of the designers include not only being able to use this information intelligently, but also joining with the users of castings in describing the needs for further property data, and being able to determine precisely the conditions of service, both theoretically and with the use of the new experimental stress-measuring techniques. The responsibility of the founders is to meet on a common ground with the designers and users and to work out the problems pertaining to the practical variables in conformity with the common understanding of their true significance as they affect the serviceability.

Data of the type needed for the cast magnesium alloys are described and a summary of the currently available design data for these alloys is given.

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CHAPTER MEMBERS IDENTIFY CASTING DEFECTS

Rochester Foundrymen Hold Recognition Contest

ABILITY TO RECOGNIZE CASTINGS DEFECTS, their causes and remedies paid off at the February 8 meeting of the Rochester Chapter of the American Foundrymen's Society. Two cash prizes and a ticket to the chapter's March meeting were awarded the three foundrymen who scored top honors in identifying 12 castings selected by a chapter committee.

Since defective castings mean increased production costs and often are the difference between profit and loss on a foundry job, Rochester foundrymen devised the contest to increase their recognition of common defects, their causes and remedies. Under the leadership of Chapter President Max T. Ganzauge, General Railway Signal Co., a committee selected 12 representative castings from a number submitted by local foundries.

The committee then determined the defect, its cause, and the best cure or remedy for it on each of the 12 castings. These determinations were then placed on a master sheet, to be used as the basis on which to judge contestants' answers.

At the meeting, the defective castings were numbered and displayed, and an entry form given each member. Contestants then were given one hour in which to view the castings and submit their answers.

While the contest committee judged the contest entries, Raymond Forkey, Rochester representative for the Norton Co., Worcester, Mass., presented two sound, color films on "*Offhand Grinding*" and "*Grinding Safety*." A discussion of Mr. Forkey's films and his accompanying talk followed.

Contestants were allowed one point for naming the defect, one point for stating its cause, and one point for suggesting the proper remedy for the casting defect in question.

First prize of 10 dollars was awarded John Racinowski, Rochester Erie Foundry, Rochester. Second prize of five dollars went to J. W. McMillan, Ingersoll Rand Co., Painted Post, and the third prize, a ticket to the chapter's March meeting, was awarded R. J. Putnam, Ritter Co., Rochester.

Following awarding of the prizes, the defective castings were discussed by the chapter members, all of whom felt that this variation from the usual chapter meeting program was both entertaining and highly instructive to the participants.

Entrants in the A.F.S. Rochester Chapter's Contest look over some of the 12 defective contest castings.

EFFECT OF SLAG TYPES ON HEAT TREATMENT OF MALLEABLE IRON

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As MODERN DEVELOPMENTS in cast iron metallurgy have focused increasingly on improved production methods, means of speeding up the rate of malleabilization of malleable iron have received considerable attention. Such means as the use of high-silicon chemistry; addition of boron to control chromium residuals; addition of inhibitors such as tellurium and molybdenum to control the tendency of the white iron to mottle; and the use of carefully controlled atmosphere furnaces have received wide publicity. Likewise, improved melting control inside the cupola and the air furnace has been extensively considered.

Less attention has been given to the practice of using straight electric furnace melting as a source of white iron for the production of malleable. It is in this latter field that some of the experience of the Ford Motor Co. may contribute to the understanding of those factors influencing the date of malleabilization.

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During a wartime program necessitated by a shortage of malleable castings, the company's steel foundry was called upon to produce malleable iron, using 15-ton electric furnaces as a source of molten metal. In developing a process specification for this manufacture, it was apparent that there was a lack of information about the details of the furnace operation. For this reason the original specification called for dead melting the heat to the proper chemical composition with an absolute minimum of correction prior to pouring; no attempt was to be made to control the slag.

At an early stage it became apparent that chemical composition, alone, was not the complete measure of the malleability of the white iron. One phase of the investigation into the causes of seeming abnormalities as regards susceptibility to malleabilization was the influence of conditions within the melting furnace, more specifically the influence of the melting furnace slag type produced.

The initial investigation consisted of correlating the heat histories, including slag condition; the heat-treat susceptibility of representative castings from these heats; and the structure, metallographical and fracture, of the castings.

The process specification to which initial production heats of iron were made was of the following order:

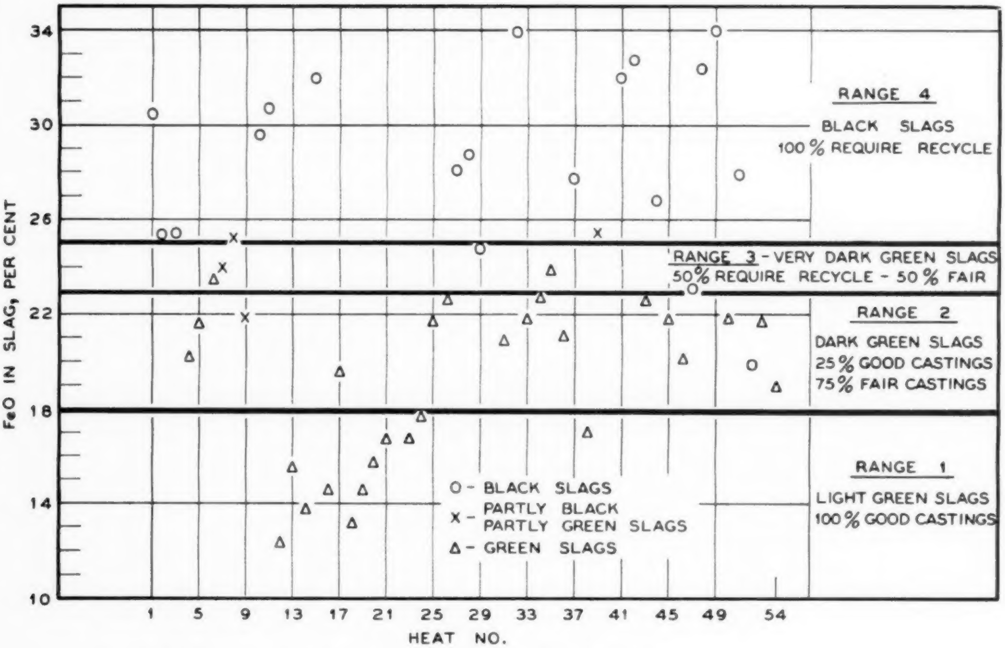

Fig. 1—Slag color ranges of the various heats and the effect on heat treatment susceptibility.

Cold melt heats shall be made in acid electric furnaces. The charges shall be composed of 40 per cent back scrap, 35 per cent pig iron and 25 per cent steel.

The metal control shall be maintained by reference to a standard 1½-in. fracture specimen for control of tendency toward mottling, and by periodic chemical analysis to the following limits:

	Per Cent
Carbon	2.35–2.45
Manganese	0.35–0.45
Silicon	1.35–1.45
Chromium	0.04 max.
Phosphorus	0.08 max.
Sulphur	0.08 max.

The heat treat cycle for the general run of malleable castings shall be as follows:

Preheat to 1500 F and hold at this temperature for 2 hr, then increase the temperature to 1750 F and hold for a period of 13 hr. Remove the castings from the furnace and air cool to a temperature below 1200 F. Reheat the castings to 1380 F, hold at this temperature for a period of 10 hr and cool at a rate of 25 degrees per hour to 1200 F and 50 degrees per hour from 1200 to 1100 F. The castings shall be removed from the furnace at 1100 F and may be water quenched or air cooled.

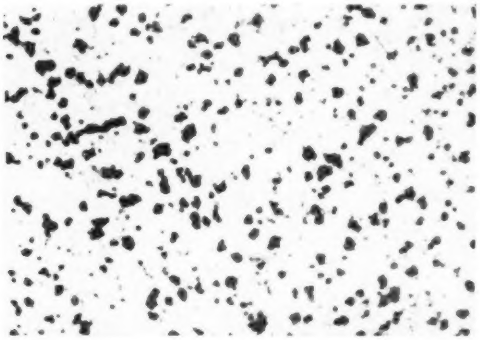

Fig. 2—Photomicrograph of annealed white iron which had a green furnace slag (below 18 per cent FeO).

Graphical representation of the data is shown in the chart (Fig. 1). It may be seen that, when the finishing slags were black (25-35 per cent FeO), 100 per cent of the castings required recycling because of mottled fractures; when the finishing slags were dark green to black (23-25 per cent FeO), 50 per cent of the castings required recycling and 50 per cent were only fair in appearance; when the finishing slags were dark green (18-23 per cent FeO), 75 per cent of the heats were only acceptable malleable, while 25 per cent were good; and when the finishing slags were light green (up to 18 per cent FeO), 100 per cent were good.

Reference to Fig. 2 will show the microstructure of a sample representative of the latter case, i.e., an annealed white iron which had a light green furnace slag, while Fig. 3 is representative of an annealed iron which had a black furnace slag. Both samples were given identical heat treatment according to the foregoing cycle. From the results obtained it is apparent that optimum susceptibility to heat treatment could be obtained by finishing all the electric furnace heats under slags containing less than 18 per cent FeO.

To verify this conclusion, operating procedures in the melting practice were set up to take advantage of this finding. Melting-down was accomplished as previously. However, when the melting-down was completed, the slag was raked from the bath and a new slag consisting of 4 parts of sand, 1 part of lime, and ½ part of powdered ferromanganese added. The new slag composition approximated 10 per cent MnO, 15 per cent FeO, 60 per cent SiO_2, and 15 per cent CaO, and its color was light green. Any tendency for the slag to become too high in FeO was controlled by additions of lime to the bath. Early in the practice of the use of slag color as an additional control measure, the following data were obtained from production heats in the electric furnace:

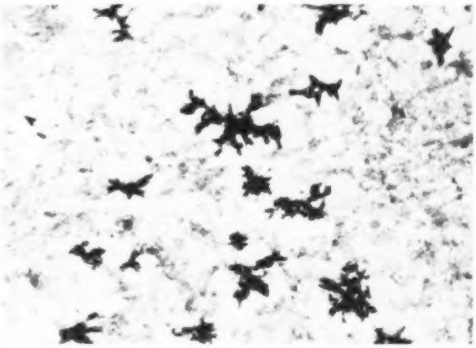

Fig. 3—Representative specimen of annealed white iron which had black furnace slag (over 25 per cent FeO).

	Control Period A	Control Period B
Number of heats	92	48
Green slags, per cent	55	75
Dark green slags, per cent	18	10
Black slags, per cent	27	15
Good castings, per cent	61	89
Recycled castings, per cent	39	11

On the basis of these data, the process specification covering the electric furnace melting of white iron for malleable, as used by the authors' company, was modified to include the slag control outlined in the foregoing. Although no data are available on the application of similar controls in duplexing and cold melting air furnace practice, the indications here were so positive that such an investigation would seem warranted.

IRISH FOUNDRY MODERNIZES

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Director
Hammond Lane Foundry Co., Ltd.
Dublin, Eire

Despite serious materials shortages, the Hammond Lane Foundry Co., Ltd., Dublin, Eire, has recently completed remodeling of its foundry facilities and has added a modern vitreous enameling plant.

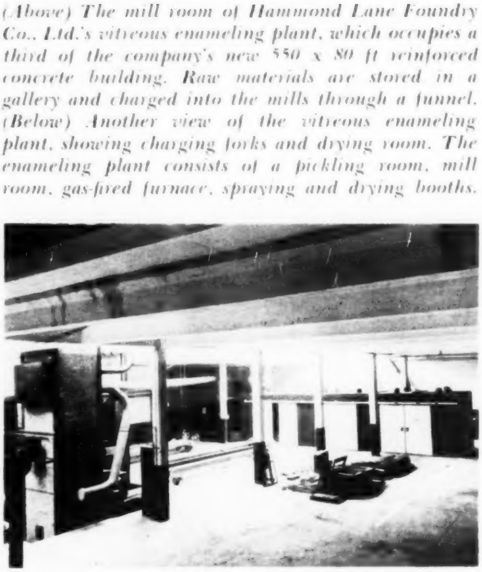
The vitreous enameling plant, molding and sand shot and blasting departments are housed in a 550 x 80 ft building of reinforced concrete, a revolutionary structure for Eire. The building has a flat roof, with louvre lantern lights running the entire length of the building. Plenty of light and ventilation are available and during casting and knockout the foundry is comparatively free of dust, steam and fumes.

The molding shops are not mechanized, because the varied products of Hammond Lane—rainwater and soil pipes, gutters, ranges, grates, cisterns and manhole covers—do not lend themselves to mechanized molding. However, four hand-squeeze machines are in use and a portable sand mixing unit is employed.

Prior to the war, the daily cast was approximately 30 tons, using two 5-ft cupolas with electric hoist gear. During the war, the cast dropped to 10 tons per day, and it was found necessary to use a 24-in. cupola in place of the two larger cupolas. This cupola has since been superseded by a 36-in. cupola and the daily cast is now about 15 tons.

Scrap iron is obtained locally and the supply position is now greatly improved, but coke and pig iron are still not available from Britain, the chief prewar source of supply. Limited quantities of scrap and pig are now being obtained from Holland and Belgium.

(Above) The mill room of Hammond Lane Foundry Co., Ltd.'s vitreous enameling plant, which occupies a third of the company's new 550 x 80 ft reinforced concrete building. Raw materials are stored in a gallery and charged into the mills through a funnel. (Below) Another view of the vitreous enameling plant, showing charging forks and drying room. The enameling plant consists of a pickling room, mill room, gas-fired furnace, spraying and drying booths.



Two views of the 28,000 sq ft molding shop in Hammond Lane's new building. There is a second, smaller molding shop located in the warehouse building, which also houses assembly and pattern facilities.

PROBLEM OF GASES IN THE INDIRECT-ARC FURNACE

Melting Brass and Bronze

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Foreman
Crane Co.
Chicago

IT IS THE PURPOSE of this paper to consider the problem of gassed metal which has been melted in an indirect-arc rocking furnace, and to present a workable practice for the correction of such metal. The author's experience has been that gassed metal is not a characteristic of the indirect-arc furnace, but rather a result of outside influences. Copper-tin alloys can be degassed by being melted with an oxidizing flux; copper-zinc alloys, or high phosphorous alloys, are best degassed by being swept with an inert gas.

Any discussion of the introduction of gases into the metal bath being melted in an indirect-arc rocking furnace should be preceded by a short description of that furnace and its melting characteristics. Primarily, the furnace consists of a steel shell which is properly lined with a suitable refractory material. This, in turn, is backed up with an insulating lining.

A carbon electrode, manually or automatically controlled, enters each side of the barrel-shaped furnace as it lies along its horizontal axis. The electrodes enter the furnace through portholes which are washed with alundum cement and held to a tolerance of plus $\frac{1}{16}$-in. compared to the electrode diameter. The carbon electrodes are so aligned that they meet on center in the middle of the furnace. Any misalignment of the electrodes would cause excessive electrode consumption and greatly reduce lining life. During the entire melting cycle, the furnace is rocked at predetermined increments of the angle of rocking in order to melt faster, produce a more homogeneous melt, and increase lining life of the furnace.

Furnace Efficiency

In a typical 8-hr shift, the conical shell furnace consumed 1,815 kwh of energy to melt 12,565 lb of red brass and bring it to a temperature of 2300 F. Since the theoretical energy consumption is 1,030 kwh, the furnace operates with an efficiency of 57 per cent. This same furnace, running continously for 24 hr, would attain an efficiency of better than 80 per cent. The electrode consumption, with the high current densities found in an indirect-arc furnace, should be near 1 lb of electrode per 100 kwh, or about 3 lb of electrode per ton of brass melted.

Metal loss in a well constructed and properly sealed furnace is less than 0.5 per cent in the case of 85-5-5-5 metal. A properly sealed furnace is one in which the electrode portholes are only $\frac{1}{16}$-in. larger than the electrode, and the door opening is sealed by the steel door leaving only the spout open to the atmosphere. If the furnace is thus sealed, and if the operator melts the metal with a clear arc in a very short time, fluxes designed to reduce metal loss will be of little help.

The indirect-arc furnace is not without its faults. As previously mentioned, care must be exercised in the construction and proper maintenance of the furnace. Reference has been made to the misalignment of the electrodes and the resulting smoky arc. Also, if the electrodes are damp, or set too close inside the furnace, the arc will not be clear. If a metal charge contains borings sufficient in mass to cover the arc, it will be smoky. Such operation must be avoided at all cost, since a smoky arc, liberating nascent carbon, will readily reduce the lining or any sand introduced with the charge to silicon. Even a trace of silicon is detrimental to red brass.

Foreign Matter in Melt

Since during the melting cycle the metal quality may be affected by all factors, the foundryman should consider each carefully. One of the most obvious causes of low quality metal is found not in the method of melting, but rather in the foreign matter introduced with the charge. Quite naturally it would not seem proper to mix the return gates and sprues of different metal formulas.

Along the same line of thought, the machine shop borings should reach the furnace in a clean and unadulterated state. All oil and possible water should be removed by passing the borings through a drying kiln, and over a magnetic pulley to remove iron chips. If sulphur-bearing cutting oils, or any other carbonaceous matter, are introduced into the furnace, the resulting metal will appear sluggish due to contained sulphides and oxides; or the castings so produced will contain gas-holes.

Under the action of heat, the hydrocarbons of the oil will break down and liberate nascent carbon. The theory is that carbon is soluble in brass to the extent of 0.003 per cent. This solubility alone has no bad effect on the metal. But if, while in solution, the carbon is oxidized to carbon monoxide (CO), the reaction product being unsoluble is mechanically trapped in the metal during solidification and appears as gas porosity. A good rule to follow is "keep the metal charge clean."

Lining-Patching Affects Metal

Next to the charge the furnace lining or patch, as the case may be, has a great influence on the metal bath. If the binder used in the construction of the furnace lining or in the patching cement has not been sufficiently stabilized or removed during subsequent preheating, metal of poor quality will result. Since water

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is an integral constituent of any patching material, nine times out of ten the resulting contaminated metal will be gassed with hydrogen (H_2) or water vapor.

Any refractory material containing sodium silicate or silicon carbide is to be avoided since any reducing condition in the furnace will liberate free silicon. Even traces of this element in red brass or bronze are detrimental. Poor furnace construction is to be avoided, not solely from the metallurgical aspects but also from the economic point of view. Loosely fitted electrode sleeves cannot be tolerated because the influx of air into the melting chamber greatly accelerates the electrode consumption and reduces lining life. Also, the resulting atmosphere tends to oxidize the more volatile elements of the brass composition.

Keep Furnace Atmosphere Unchanged

Some foundrymen purposely introduce into the indirect-arc furnace a stream of air. The theory is that with a limited supply of oxygen in the presence of nascent carbon, the ambient atmosphere is largely carbon monoxide (CO). The use of an air stream is to oxidize this gas to carbon dioxide (CO_2) and maintain an oxidizing atmosphere. However, this practice is followed in only a few foundries. If the atmosphere inside the furnace is left unchanged, no detrimental results will occur in the metal. This is in keeping with the findings of numerous investigators who have studied the effects of CO on brass and bronze.

The actual melting practice for an indirect-arc rocking furnace is simple compared to that for any other furnace. All that is required of the operator is the ability to read a kwh meter and push a few buttons. The operator must be careful not to rock the furnace too soon lest the bulky charge break the electrodes; also, he should avoid superheating the metal bath. Any metal heated excessively beyond its pouring temperature will have a great tendency to absorb gasses, mainly hydrogen or water vapor, from whichever source is at hand. This source may be a wet patch in the furnace, the surrounding atmosphere as the metal is tapped from the furnace, or an insufficiently dried ladle.

Speculation exists that the metal and air contact as the metal is poured into the mold is sufficient to cause inverse segregation. Investigators have indicative evidence that the effects of molding sand moisture, mold hardness, and the high phosphorus content of the metal may bring about a gassed metal condition. All of these influences can be at work to spoil the metal. Of these poor metal conditions, the easiest to bring about is the introduction of one or more detrimental elements into the furnace.

Causes of Gassed Metal

In all of the investigations conducted by the author, gassed metal coming from the furnace was caused by conditions or substances that were placed in the furnace. A gassed metal condition was brought about by the introduction of hydrogen or water vapor by any of the aforementioned processes. So far most investigations have attributed casting porosity defects to metal gassing with hydrogen. Occasionally, a fracture appearance indicates that oxygen may have been responsible; however, insufficient work has been done in these cases. Similarly, the idea of metallic hydride contamination, a possibility since hydrogen acts like a metal, has received only scant attention.

By virtue of the furnace construction and operating characteristics, the atmosphere inside the furnace is reducing. Other investigators have analysed the gases in an indirect-arc furnace melting brass and bronze, and have found the gases to consist of nitrogen and carbon monoxide, and very little else. The actual atmosphere inside an indirect-arc furnace depends largely upon the metal being melted. Carbon monoxide can be reducing, neutral, or oxidizing. In the case of melting pure copper, the carbon monoxide in contact with the melt, removes all oxygen:

$$2CO + O_2 \rightarrow 2CO_2$$

If the furnace is used to melt aluminum, the carbon monoxide acts as an oxidizing atmosphere:

$$6Al + 3CO \rightarrow Al_4C_3 + Al_2O_3$$

Many investigators have melted brass and bronze under an atmosphere of carbon monoxide, or have bubbled this gas through the melt without encountering any deleterious effects on the metal. In view of those findings the indirect-arc furnace can be considered as having a neutral atmosphere in conjunction with a brass or bronze bath. Of all the different gases which may be present in the ambient atmosphere inside a furnace, most investigators agree that hydrogen or water vapor is the principal source of trouble.

Maintain Equilibrium

The resulting defect may present itself in the casting in the form of minute pinholes caused by the decrease in solubility of hydrogen in the metal during its solidification range, or by the reaction product between hydrogen and oxygen, or an oxide. The reactants to such an oxidation reaction, be they oxygen in solution with hydrogen, or carbon, or sulphur, may coexist in the same metal bath and cause no trouble as long as the equilibrium is not disturbed. Once the equilibrium has been upset through the addition of phosphorus, or a lowering of the temperature of the melt, pinholes or microporosity may result.

Investigators have determined that only 0.072 cubic centimeters of hydrogen are necessary to combine with half that amount of oxygen to produce a casting possessing 3 per cent voids. The best and most economical method of producing relatively gas-free metal is to be certain that no moisture or gas-producing substances enter into the melting practice. As previously stated, the metal charge must be clean. Great care should be taken that the metal is melted in a dry furnace and is tapped into a dry ladle.

Superheating the metal in the indirect-arc furnace is costly and increases the chances of gas absorption upon contact with the atmosphere. However, the author has obtained good mechanical properties in metal that was held in the furnace and subject to repeated reheating because of some unavoidable breakdown. Gas absorption in brass or bronze varies with the temperature of the bath, and seems to decrease with increasing percentages of tin and zinc. However, this is of academic value only since even at the conditions of lowest hydrogen solubility the resulting voids will be sufficient to cause rejection of the casting.

Two methods quite commonly used for reducing gas content of the metal are: (1) melting in conjunction with an oxidizing flux, usually cuprous oxide (Cu_2O) or manganese dioxide (MnO_2); and (2) sweeping the bath clean with some dry, inert gas. The question might be raised—why not oxidize the melt first and follow with some reducer to eliminate hydrogen and the reaction product, water vapor? This process is quite feasible in a copper-tin bronze. The oxidizing condition removes hydrogen corresponding to the high oxygen content; subsequent reduction with copper-phosphorus reduces the high oxygen content to a point sufficiently low that no water vapor would form as the metal freezes.

In the case of highly reducing brasses such as those having high zinc or phosphorus contents, the addition of excess oxygen will first oxidize those elements which have the highest heat of formation. In such cases,

Tapping a heat from one of a battery of indirect-arc rocking furnaces used in brass and bronze melting.

method (2) is preferred. Since perhaps all investigation points to the fact that a nitrogen atmosphere gives maximum soundness to the metal, the writer preferred this method of degassing.

For this experiment 1,000-lb heats were melted in a conical shell rocking furnace both before and after the furnace was repaired with 600 lb of patching material. This procedure was repeated using dry nitrogen as a scavenging gas. The nitrogen gas, obtained from a reputable source, was reduced in pressure from 2,000 to 10 psi and introduced into the bottom of 250 lb of metal in a ladle by means of a 1/8-in. extra heavy steel pipe. Unfortunately, the outside diameter of the pipe was somewhat corroded and probably carried some water of crystallization into the bath. The nitrogen was allowed to bubble through the melt for 45 sec, after the addition of 1½ oz of 15 per cent copper-phosphorus per 100 lb of melt.

Four crown-gated Webbert test bars were poured, starting at 2250 F and decreasing in pouring temperature in 50-degree decrements. The test bars, cast in natural sand, were analyzed chemically and physically.

Table 1—Comparison of Physical Properties of Untreated and Nitrogen Treated Red Brass

Test Bar No.	Pouring Temp., F	N_2 Treated	Tensile Strength 1000 psi	Yield Point (Divider Method), 1000 psi	Elongation, % in 2 in.	Apparent Density, gm/cc
1	2250	No	36.7	20.0	27.0	8.71
2	2200	No	32.5	20.0	17.0	8.80
3	2150	No	37.0	20.0	23.5	8.82
4	2100	No	37.0	20.5	27.0	8.84
6	2200	Yes	36.0	20.5	24.0	8.89
5	2250	Yes	33.3	20.0	18.0	8.71
7	2150	Yes	36.8	20.0	26.0	8.86
8	2100	Yes	36.0	20.5	22.0	8.88

Apparent density determinations were made using the unmachined and unworked ends of the test bars. A comparison of the chemical compositions showed no difference between the untreated and nitrogen-treated bars. The physical properties of the untreated bars compared favorably with the treated samples. However, the apparent densities, determined by the difference o' weight when weighed first in air and then in water, seemed to be slightly better in the "swept" metal.

The author believes that the use of a properly cleaned and dried lance would improve the densities still further. Moreover, it is not believed that a high-density metal insures good physical properties, but a low-density metal does mean inferior metal. Fractures of these test bars tended to exhibit a denser structure in the nitrogen-treated metal.

Conclusions

The author submits the following conclusions:

1. Gassed metal is not a defect nor an operating characteristic of the indirect-arc rocking furnace.

2. A gassed metal condition may be brought about by an "outside" influence; be it water in the charge or in the furnace lining, or such impurities as sulphur or carbon which may give off gaseous reaction products in the metal.

3. Carbon monoxide atmosphere inside a furnace which is efficiently operated with a clear arc will not be harmful to brasses and bronzes.

4. A dirty, smoky arc liberating nascent carbon may produce gassed metal by virtue of the slight solubility of carbon in red brass.

5. Superheating or reheating the metal bath will produce no deleterious gas condition in the furnace.

6. The reducing atmosphere inside the furnace does not reduce the foundry sand on the gates to free silicon.

7. Due to the relatively close tolerances in the refractory of the furnace, oxidation loss of the brass or bronze is held to a maximum of 0.5 per cent.

8. Copper-tin alloys may be melted with an oxidizing flux in the furnace to reduce gassed metal because the hydrogen content is greatly reduced in the presence of a high oxygen concentration.

9. The practice of blowing a stream of air into the furnace is not widely followed. In a normally operated furnace, no apparent benefit seems to be gained from this procedure.

10. Brasses containing considerable zinc and phosphorus may be swept with an inert gas such as nitrogen to lower the hydrogen concentration of the melt and thus reduce the possibility of producing gassed metal.

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OXIDIZING STEEL HEATS WITH OXYGEN GAS

The use of oxygen gas instead of iron ore as an oxidizing agent is now becoming standard practice in making electric steel. It has won this position as an important tool in the steelmaking industry because of its speed in refining steels to a .15% carbon content or lower. Oxygen gas also has been used successfully in refining medium carbon grades of steel. Previously, it was deemed too prohibitive in cost for economical use in refining those steel grades.

In the basic electric furnace, oxygen performs three functions in the ingot production cycle—it removes carbon, controls bath temperature and melts scrap. Essentially two methods of introducing oxygen into metal baths have evolved to get these results.

One method consists of injecting the oxygen into the bath slightly below the slag metal interface by an iron pipe lance. The flow rates and pressure are varied between 10,000 and 30,000 cu ft per hr, the amount of pressure determined by the size of the furnace and the amount of decarbing desired.

The other method makes use of a non-consumable water-cooled device to direct the oxygen through the slag into the metal. Naturally, this calls for the use of higher pressure to force the gas through the slag surface in order to reach the metal.

One reason for the popularity of oxygen gas for the removal of carbon is that it provides an oxidizing reagent immediately available for use in the metal bath. There is no need for decomposing chemical compounds or preheating and fusing solid materials.

Reduces Adjustment Time

As a result, all of the reactions of oxygen gas with carbon or other elements such as iron, chromium or manganese are exothermic—the rate of carbon removal being a direct function of the supply rate of the oxygen. Time for adjusting the carbon content of the bath is cut to the bone. This characteristic of oxygen gas is especially beneficial with low-carbon heats.

In developing the use of oxygen in electric furnaces, it was apparent that savings would be made in the manufacture of low carbon grades of steel. But it was not considered practical to use oxygen on steels which were finished with a carbon content of .20 per cent or higher as there were insufficient power savings and no shortened cycle times to offset the cost of the oxygen.

Recently, however, the oxygen gas injection method has been used successfully in small acid electric furnaces for producing casting grade steels. Experiments have been conducted on 2- to 15-ton furnaces.

For these small furnaces, new methods had to be devised for introducing the oxygen into the metal baths. Since acid slag forms a protective coating on the pipe inserted into the bath, the need for high oxygen pressure to conserve pipe life was ended. Furthermore, high oxygen pressures could not be used because damage might result to the walls of the small furnaces.

For furnaces of two to six ton charges it was found that flows of 6,000 to 8,000 cu ft per hr at pressures of 30 to 40 psi were best. The use of ¾ in. pipe proved satisfactory and four or five heats of six tons could be decarbed with one length of pipe.

Quality of castings is equal to that produced by ore. Tests have indicated that the physical properties of aged and unaged bars remain the same. Some users claim that the use of oxygen produces metal that has greater fluidity thus producing cleaner, sharper castings with good shrinkage and soundness. Until other evidence proves to the contrary, it is safe to assume that oxygen does not affect the quality of castings adversely.

As in basic furnaces, the use of oxygen in acid furnaces gives rapid carbon removal, bath temperature control and increased production rates. In the manufacture of Grade B carbon steel great care must be taken in regard to the temperature of the bath before the introduction of oxygen. If the bath temperature is too high carbon will be oxidized but small amounts of silicon and manganese will be lost. Temperatures ranging between 2850 and 2900 F were found to be best. At these temperatures silicon and manganese will be oxidized to same levels as in ore practice.

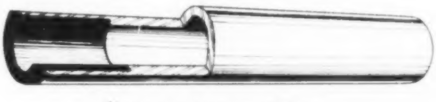
All information to date indicates that the use of oxygen gas in acid furnaces is economical as well as practical. To date only one snag has developed.

When the temperature rises rapidly as is the case in the lower carbon ranges, viscous slag is produced. To offset this condition, small amounts of lime must be added to increase the slag fluidity.

Editor's Note: This article is condensed from the September, 1948, issue of *International Digest*, and is the result of research conducted by J. H. Berryman and J. M. Crockett of the Air Reduction Co.

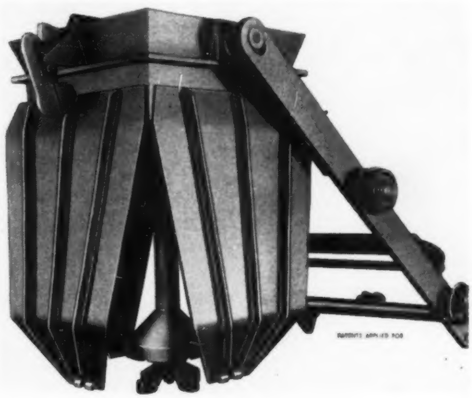
"AN EXHIBIT ON PAPER"

AMERICAN FOUNDRYMAN herewith presents the first of two articles designed to provide a showcase for the display of the newest developments in foundry equipment, materials and services at Convention time in a year when the biennial A.F.S. Foundry Congress and Exhibit is not held. On the pages of this "Exhibit on Paper" will be found the outstanding tools of the foundry craft that have been developed recently by the nation's equipment and materials manufacturers. More detailed information on the products described here can be obtained by filling in the convenient coupon on Page 114.



1. Sand Arrester Tube

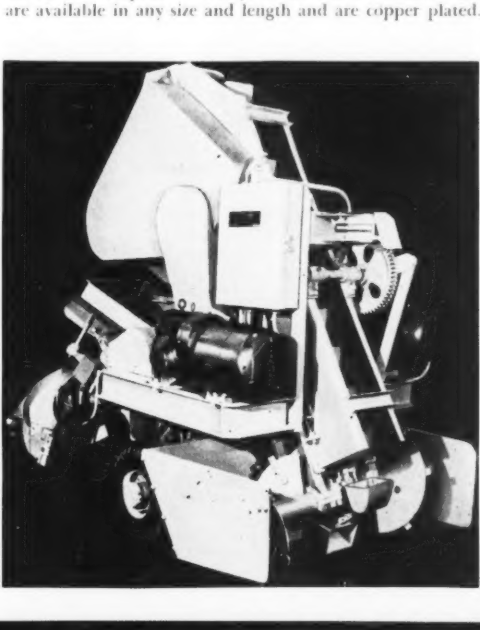
Designed to eliminate the stems that occur on cores made on combined blower and draw machines, Martin Engineering Co.'s sand arrester tube prevents the sand stem from drawing down by means of a resilient, abrasion-resistant material bonded into the end of the tube. This material forms a choke effect at the lower end, effectively stopping the sand column. Easily handled and contoured to meet internal configuration of the core cavity, these tubes effect savings in installation time and increase production of perfect cores. Rust-proof and easy to insert, sand arrester tubes are available in any size and length and are copper plated.



2. Cupola Charging Bucket

A new cone-type, square-top charging bucket with side discharge doors developed by the Modern Equipment Co. is especially recommended for charging large-diameter cupolas. The small center cone and large side-discharge doors produce an evenly-distributed charge having compact sides and a loose center. As a result, air penetrates to center of stack, promoting even melting and efficient operation.

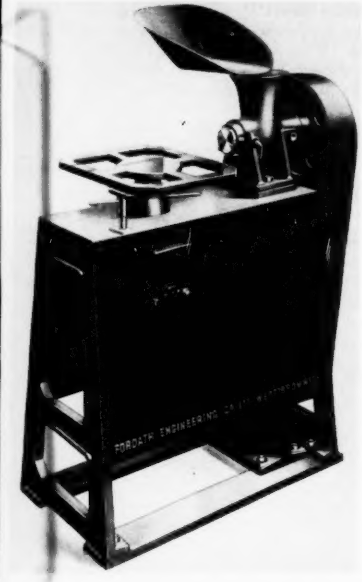
3. Sand Conditioner



Providing complete sand conditioning from loading to discharging, Beardsley & Piper's Nite-Gang provides the molder with thoroughly blended, iron-free, evenly-tempered, fully-aerated sand at the lowest possible cost per ton. Self-propelled, the Nite-Gang eliminates the need for sand windrowing and reduces laborious sand handling to push-button ease. In loading operation, all sand is completely blended. Magnetic separator removes tramp iron and discharges it into container. Nite-Gang breaks lumps and screens, aerates the sand twice, discharges it into windrows behind or at side of machine, or throws as far as 40 ft into pile or bin in 240 degree arc. Speed is variable from 4½ fpm to 36 fpm, forward or reverse. Maneuverability is excellent.

4. Edge Grinder

The Cleco edge grinder rapidly performs roughing and final finishing operations without damage to surrounding surfaces. Adaptable to all metals. Weight: 8-¾ lb; height: 7-¾ in. Free speed: 8,000 rpm. 7 x ¼ in. flexible wheel.

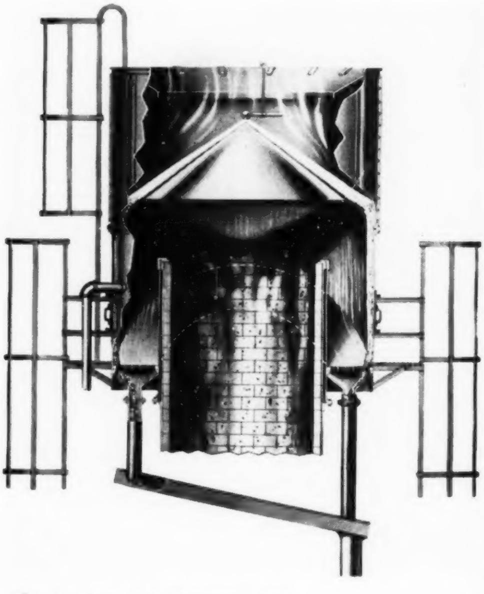


6. Degasifiers

Four new degasifying products announced by Foundry Services Incorporated are: (1) Aluminum degasser No. 190—produced in tablet form for efficient degassing and for refining the grain structure of aluminum alloys; (2) Cuprex blocks—a simple method of applying oxidation-reduction technique for insuring maximum density and minimum gas content in brass, bronze and nickel alloy castings; (3) Magnesium degasser No. 200—tablets that degas magnesium alloys and refine the grain structure without superheating the metal; (4) IR tubes—tubes that will degas, deoxidize and clean iron.

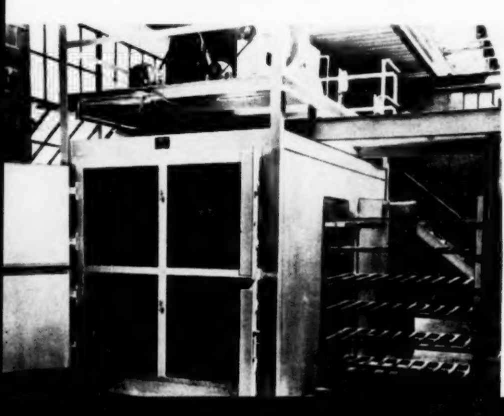
5. Multiple Core Machine

The Fordath multiple rotary core machine extrudes as many as 10 cores simultaneously in ⅛ in. and ¼ in. diameters, two at a time up to 2-⅝ in., and in diameters to 6 in. singly—smaller cores automatically vented if required. Available in two sizes, either hand or motor powered.



8. Core Oven

This core oven, developed by the Lanly Co., combines shelf, drawer and rack-type spaces and is heated by one convection heater mounted on top of oven. Any or all drawers open without disturbing the others.



7. Cupola Ash Suppressor Unit

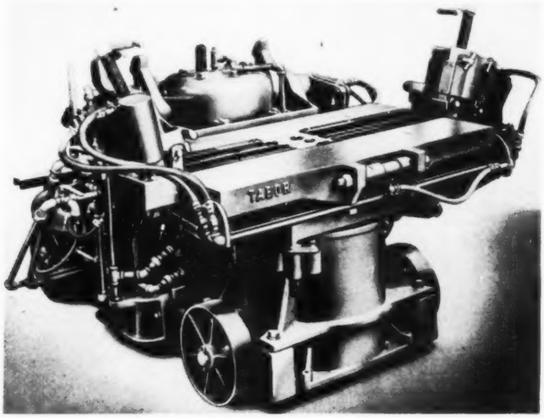
An unusually efficient and inexpensive cupola spark, ash and fume suppressor developed by the Whiting Corp. is made of rigidly enforced steel plate and telescopes over top of cupola. Water forced through special nozzle forms a thick sheet from edge of cone to inside of suppressor shell. Ash, gases, etc., are throughly wetted and washed into sludge discharge, thence dirt-laden water is drained to settling tank for sludge removal and may be recirculated if desired.

9. Wet Blasting Equipment

Designed to fit any application for core removal and castings cleaning, Hydro-Blast wet blasting equipment cleans not only the casting completely, but the sand and surrounding air as well. Cleaning can be accomplished with the operator either inside or outside the blasting room, and with or without the use of a turntable. Model shown in operation is particularly applicable to large castings.

10. Jar, Power Rollover-Draw Machine

Tabor Mfg. Co.'s jar, power rollover, power draw machine completes its cycle in 35 seconds or less—including delivery of the mold to a hydraulic device which cushions it down to desired conveyor level. A feature is the new air-operated double clamp. Pattern changes formerly requiring 5 to 10 minutes now take only that many seconds. New plate design permits an independent setting of all four clamps.



11. Fireclay Mixture

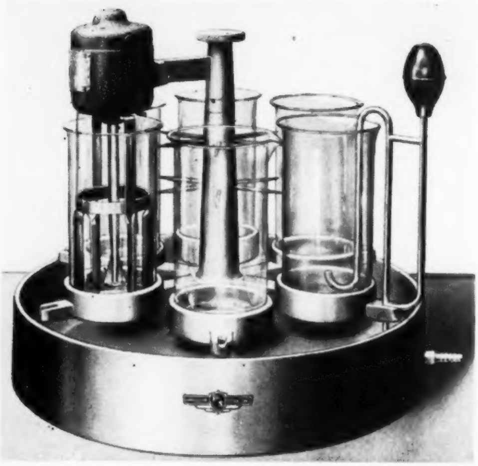
Finely ground, A. P. Green Fire Brick Co.'s new high alumina fireclay mixture is designed as a jointing material for use wherever resistance to molten iron, steel or slag is required. Highly refractory, this mixture has a pyrometric cone equivalent of greater than Cone 36 (3290 F). Lack of shrinkage and resistance to slag action makes it applicable for use where erosion of joints and metal penetration into joints would normally shorten firebrick lining life. Mixture bonds well at high temperatures because of plasticity of its bonding clay ingredients. Because it has no air-setting qualities, bond is easily broken when wells or lining are torn out. Mixture is shipped dry in multi-wall, 100 lb bags, and needs only mixing with water.

12. Resin Binder

Cores for casting illustrated at left were made with Borden Co.'s plastic binder FB-104, a new resin binder which the manufacturer claims reduced core baking time from 8-10 hours to 3-4 hours, leaving smoother inside core surfaces. FB-104 sets without oxygen and produces a collapsible core.

13. Portable Sand Muller

An entirely new, low-cost, completely-portable sand mixer for a wide variety of foundry applications has been developed by the National Engineering Co. The Porto-Muller incorporates such advantages as: (1) complete portability—no hoists or supports required; (2) ease of handling—rolls on standard 6:00-16 tires with anti-friction bearings; (3) handles 250-300 lb of sand easily; (4) 3 hp, 1800 rpm motor; (5) spring adjustment pre-loads mullers within range of 100 to 275 lb to provide correct muller weight for all types of sand; (6) simple V-belt drive protects reduction unit against sudden impacts; (7) instant readiness for operation—operator merely fastens adjustable handles, plugs into outlet.

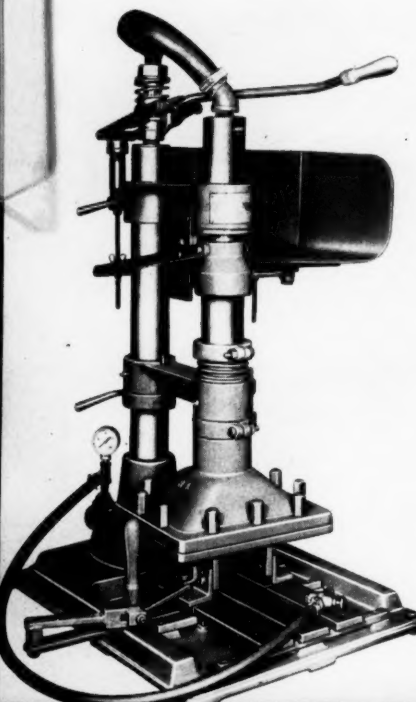


14. Sand Washer

Developed for determining clay content of molding sand in accordance with standard procedures, Precision Scientific Co.'s sand washer holds six tall-form beakers, has an electrically-operated impeller and a siphon. One of five new sand testing devices, the sand washer agitates the mixtures, then siphons out the wash water.

15. Metal Additives

Two recently-developed products—a carbon raiser and desulphurizer briquettes—are announced by the Federal Foundry Supply Co. The Federal No. 946 carbon raiser is in lump form averaging 2 in. with maximum of 4 in. diameter and is recommended for cupola use. Eight pounds of carbon raiser provide the same carbon content as 100 lb of pig iron, making possible the melting of high scrap (even 100 per cent) without sacrificing casting quality. Reduces range of carbon content fluctuation and offers better control of carbon analysis. Desulphurizer briquettes can be added in cupola, furnace or ladle, and melt at 1564 F. Cause impurities to combine chemically to form slag. Packed in 100 lb paper bags for convenience in handling.



16. Molding Machine

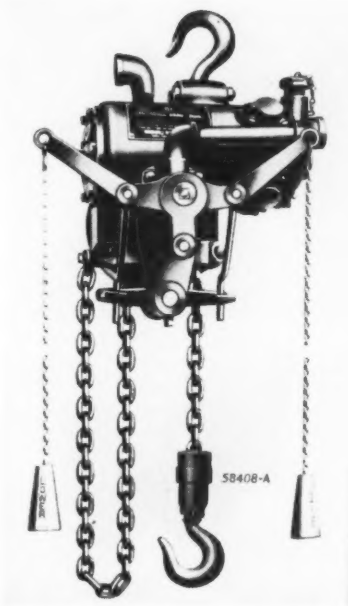
A new machine for large match plate molding designed by the Osborn Manufacturing Co. offers the jobbing and semi-production foundry lower production costs and the elimination of heavy lifting. The No. 3130 match plate molding machine jolts and squeezes the mold and mechanically lifts and handles the mold during the rollover, drawing of the cope and closing operations. Will handle wide range of flask sizes.

17. Core Blower

The Model B Randall core blower features new design and lower price. Clamps and blows horizontal boxes with a single motion. Easy for even an inexperienced operator to handle. Uses boxes up to $6\frac{1}{2}$ in. high in vertical, horizontal or odd shapes. Easy to adjust.

18. Air Hoist

A new size, the LC-10, Ingersoll-Rand air hoist handles loads up to 1000 lb. This lightweight, portable overhead hoist can easily be moved about and hung in position to handle a variety of lifting jobs. Available in five sizes, with automatic up-and-down stops and durable air motor.

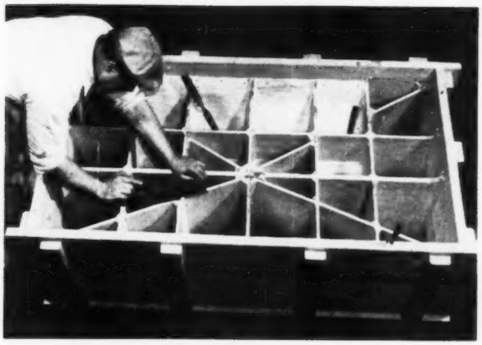


19. Core Baking Tunnel

Induction Heating Corp.'s Model M-1800-A electronic core baking tunnel has a capacity of 1500-2000 lb of sand per hour, depending upon moisture content, at a power cost of 92 cents per hour. Cores up to 12 in. high and 30 in. wide are accommodated. Reduces core baking time from hours to minutes—for example, it will bake a 100 lb block of core sand mix, 2 per cent moisture content, in 3 min.

20. Refractory Materials

Two new Laclede-Christy products are Slagtite, an iron and slag resisting refractory for ladle linings, and Metaltite, a finely ground, carefully controlled jointing material. Slagtite contains Missouri clays and graphite and is said to increase service days of lined ladles as much as six times. Metaltite is used for dipping or trowelling in laying firebrick and as a general cupola maintenance material.

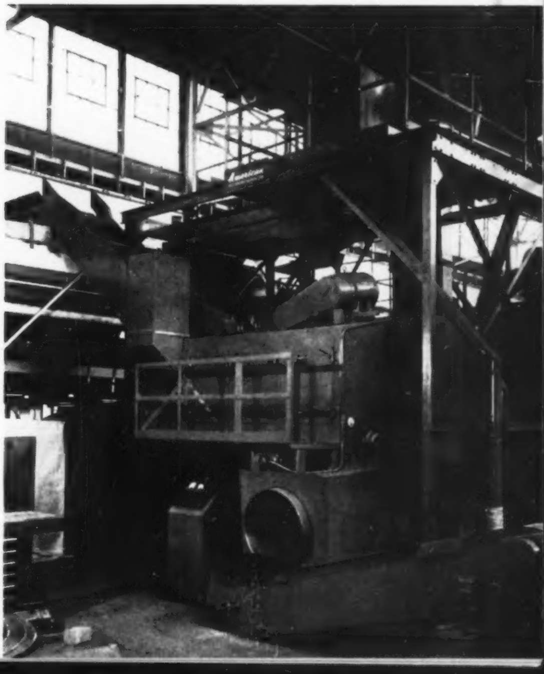


21. Wood and Wood Products

Photograph above shows a wood pattern made by Dougherty Lumber Co.—one of several services offered by this firm to the foundry industry. Others include supplying flask and pattern lumber, skids, pallets, bottom boards, crates.

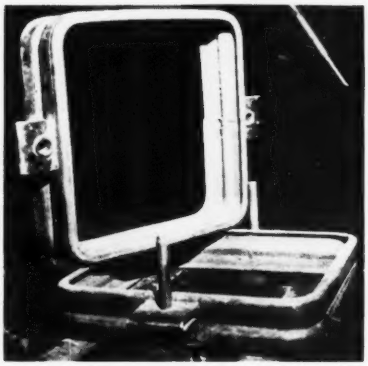
22. Tumbling, Blasting Machine

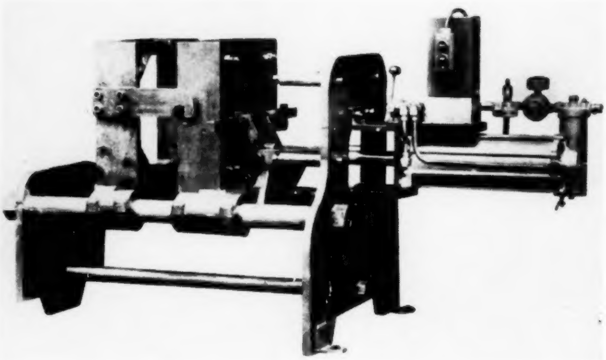
Newest model of the Continous Wheelabrator Tumblast is designed to handle a large volume of heavy production work. Tumblast combines tumbling and longitudinal travel of the work for continuous flow operation. Castings are carried through 48 in. blast barrel on endless apron, constantly tumbled to expose them to abrasive blasts.



23. Foundry Flasks ➡

Long-lasting and dependable, Black, Sivalls, & Bryson, Inc.'s all-welded steel foundry flasks are manufactured for every type of foundry use, made to foundry specifications, built to give maximum service and not burdened with unnecessary weight. Flasks made from $^3/_{16}$ in. steel are produced for non-ferrous foundries with $^1/_4$ in. plate used for heavier castings, and steel plate from $^3/_8$ in. to $^1/_2$ in. for service under strenuous conditions.



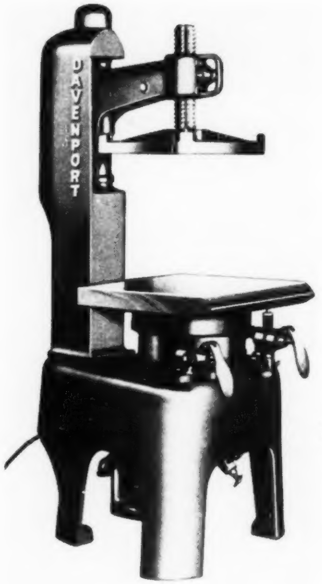


⬆ **24. Permanent Mold Machine**

A pneumatic draw table machine for permanent mold castings, developed by the Master Pattern Co., is designed to increase casting production and reduce manual fatigue. Features are: (1) air cylinder actuates mold blocks and automatic clamp with one lever; (2) automatic ejector; (3) easy interchange of mold blocks; (4) automatic mold clamp; (5) sturdy, simple design. Pneumatic tables and mold blocks are furnished ready to run.

26. Core and Mold Wash

Ten principal features characterize Delta Oil Products Co.'s core and mold wash: (1) moisture proof; (2) no precipitation; (3) highly refractory; (4) unusually high fusion point—over 3100 F when mixed with 140 mesh silica flour; (5) liberates no vapors; (6) adheres to sand surfaces; (7) easy to apply; (8) produces smooth surfaces—free from burn-in or metal penetration; (9) cuts cleaning costs; (10) economical to use.



⬆ **25. Molding Machine**

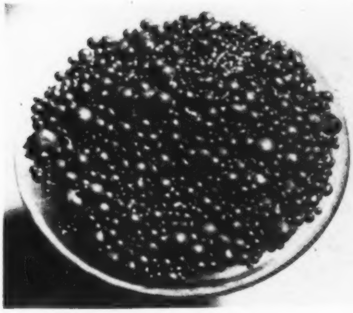
One of the newest of 60 models of modern foundry molding machines produced by Davenport Machine and Foundry Co., model shown above features electrically controlled push-button squeeze.

⬅ **27. Dust Collecting Hoods**

Kirk & Blum "over-and-under" dust collecting hoods pick up fine dust particles normally released during shakeout operations. In other parts of the foundry, Kirk & Blum systems remove fumes from mold cooling conveyors, dust and chips from snagging and grinding operations. Piping designs meet A.F.S. standards.

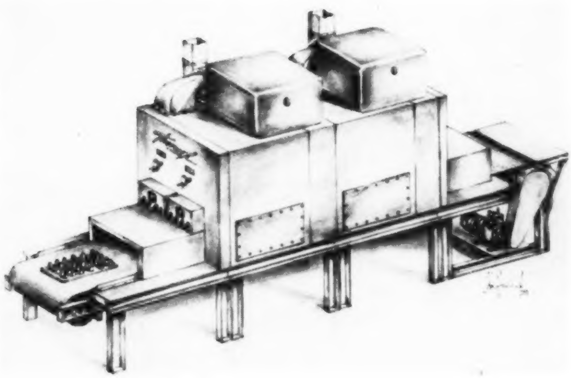
28. Mold Anchors

Milwaukee Chaplet & Mfg. Co.'s newly-developed mold anchors provide a positive means of overcoming shifts or slippage between cope and drag. Inserted in the sand along the parting line, they keep the cope and drag perfectly aligned as the flask is removed, and through subsequent handling operations. These mold anchors also eliminate the need for expensive offset pattern plates.



29. Copper Shot

Alter Co.'s copper shot improves iron, results in sharper castings, greater Brinell hardness; increases tensile and transverse strength, wear and heat resistance. Alter copper shot is available in convenient steel containers.

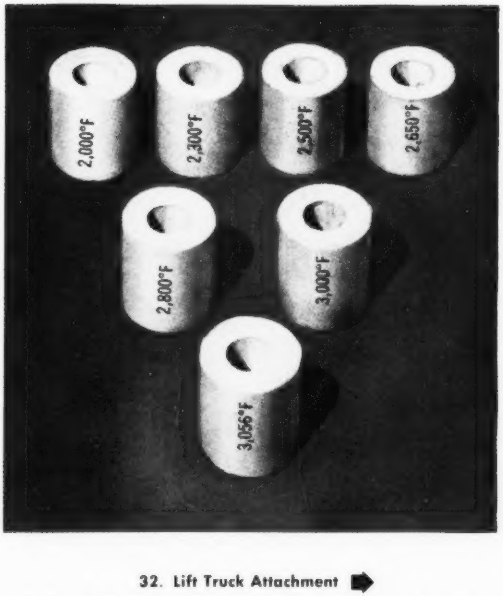


30. Electronic Core Oven

High frequency core baking equipment developed by the Girdler Corp. increases production, saves labor and improves core quality. Depending upon moisture content of core, electronic baking may require only a few seconds—never more than a few minutes. This equipment saves storage space, finishing room man-hours. Uniform heating prevents burned or broken surfaces, slumping, sagging, stresses, and improves dimensional stability and cuts fuel costs.

31. Core and Mold Coatings

A new principle in core and mold coating manufacture is embodied in Frederic B. Stevens, Inc.'s new coating material. Test cylinders of this material, shown at left, were brought up to heat in muffle furnace for seven hours and held at test temperatures for two hours. There was no distortion of cylinders at 2000 F, 2500 F, 2650 F or 2800 F, and no creeping, cracking, spalling or flaking off. Cylinder fired at 3056 F reached final fusion point.



32. Lift Truck Attachment

A clamshell bucket of $\frac{7}{16}$ yd capacity is mounted on a Hyster Co. "40" lift truck to handle sand, coke and other bulk materials in the foundry. Other attachments available for Hyster lift trucks are towing hooks, booms, scoops and a hydraulic side squeeze device for palletless handling.

33. Carbon, Graphite Products

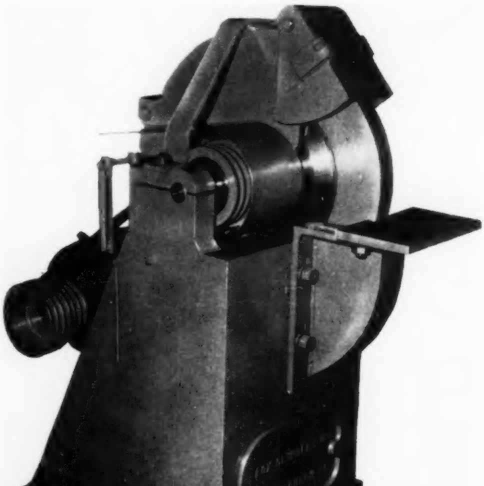
Among the several products of National Carbon Co., Inc., of special interest to the foundry industry are such developments as: (1) graphite tubes for cleaning molten metal—with unusually long life because graphite is unharmed by temperature changes, and which will not contaminate metal by going into solution; (2) graphite riser rods, which keep blind risers open to atmosphere during solidification of steel, prevent warping of castings by atmospheric pressure, and leaves shrinkage voids in risers instead of castings; (3) carbon trough liners which are unaffected by thermal shock and do not adhere to hot metal, allowing trough to be prepared for next cast in few minutes. Can be used equally well for slag runners; (4) graphite skimmer floats, available in 4 to 9 in. diameters, which retard formation of oxides by covering the hot metal and automatically hold back slag and dross, providing a convenient, economical method for pouring clean metals from crucibles.

34. Shakeout Vibrator

Redesigned and greatly improved, Cleveland Vibrator Co.'s Type LSH shakeout vibrator reduces flask cleaning time to a minimum without damaging the flask. Hook head is engineered for use on pressed steel or cast flasks of all sizes and thicknesses, and will remove cores from large castings. Obtainable in 3, 4 and 5 in. piston diameter sizes, ruggedly constructed and with wide flange or hook head designed to eliminate tipping.

35. High Speed Grinder

A newly-developed series of high-speed stand grinders announced by Fox Grinders, Inc., has special wheel mounting and bearing construction to provide maximum wheel clearance and increased efficiency in grinding a wide variety of casting shapes. Guaranteed for two years against repairs, these grinders are available in several wheel sizes, with power ratings of 5, $7\frac{1}{2}$, 10 and 15 hp, with greater ratings available.

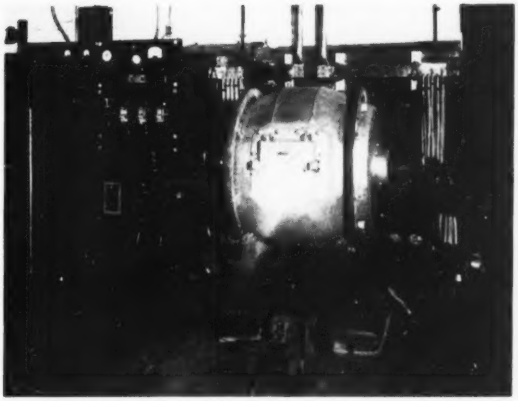


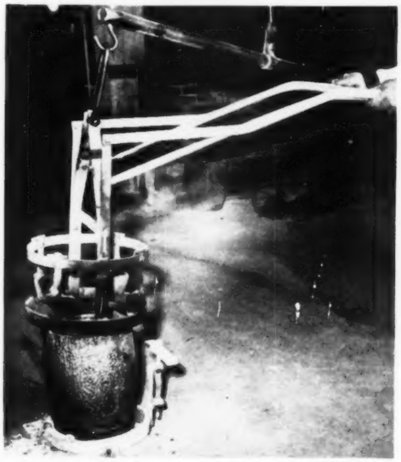
36. Tilting Arbor Saw

Built for production line work, a new tilting arbor circular saw developed by the Delta Mfg. Division of Rockwell Mfg. Co. has a table 25 in. deep by 33 in. wide and has all working parts completely enclosed. Features of the saw are its $2\text{-}\frac{5}{16}$ in. deep cutting capacity, maximum 45 degree cut of $1\text{-}\frac{5}{8}$ in. and ability to make dado cuts up to $\frac{13}{16}$ in. wide. Fully adjustable, the saw can be made level with table surface. Blade guard rides with the work, with anti-kickback fingers mounted on saw splitter. Blade raising and tilting mechanisms lock securely. Motor plate will take any frame motor, with magnetic or manual starters.

37. Rocking Electric Furnace

Unusual adaptability and versatility in the melting of ferrous and non-ferrous metals are the outstanding qualities of the Type LFN Detroit rocking electric furnance. Electrodes are clear of molten bath at all times. Controlled rocking action keeps bath constantly stirred. Insulating lining reduces heat radiation to minimum. Close electric control over input permits wide range of time-temperature relationships. Furnace controller makes operation practically foolproof. Other models are available in 10 to 4000 lb capacities.





38. Cradle Tongs

A cradle tong that eliminates cracked pots and arguments about out-of-shape tongs, and will not open and drop a pot has been developed by Hutchinson Foundry Products. Cradle tong carries crucible in same manner as in a pouring shank. There is no squeezing or crushing action against the upper walls. Tongs are built for all standard crucibles and wedge action is ample to handle all normal variations in dimensions. Clearances in furnace are liberal.

39. Binders and Wood Flour

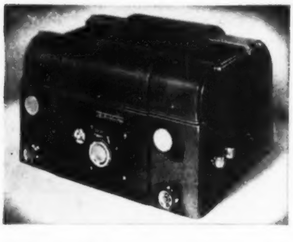
Three products of the American Colloid Co., developed for use in foundry sand mixtures are: (1) western bentonite—a Wyoming-type bentonite used for bonding molding sands and providing high hot and dry strengths, moderately high green strength, and good durability; (2) southern bentonite—a Mississippi bentonite imparting high green strength and moderate dry strengths to sands; and (3) wood flour—produced in Mississippi and used principally to reduce volume changes, to provide reducing atmosphere and to act as an extender for seacoals, cereals and pitches.

40. Brinell Hardness Reader

Harry W. Dietert Co.'s Brinell hardness reader reads direct from an impression on any machined, rough ground or cast surface. Number is read on dial as easily as telling time by a watch. Small enough to carry in the pocket, the reader eliminates eye strain and consulting of tables, and can be used by any worker.

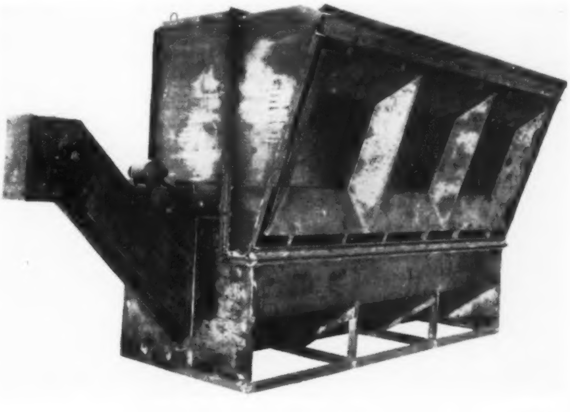
41. Wet Surfacer

Buehler, Ltd.'s No. 1251 AB duo-belt wet surfacer, in the wet preparation of specimens for metallography, follows grinding sequence from very coarse to very fine. Belts may be used wet or dry, in grits from 80 to 600. A ½ hp. two-speed motor drives both belts at either 1600 or 3200 fpm. Machine is designed for bench mounting, using external water connections or other coolants.



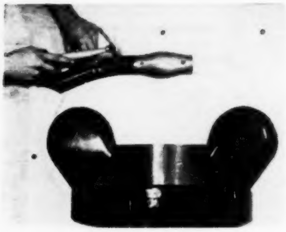
42. Shakeout Booth

Complete with intake hood, air cleansing process and exhaust fan, Newcomb-Detroit Co.'s shakeout booth is available in five standard sizes for use singly or in combination to collect dust from shakeout, knockout, shaker screening, sand transfer, mold conveyor and pouring operations. Features: automatic sludge conveyor, continuously circulating water, only one moving part—the fan. Delivered assembled.



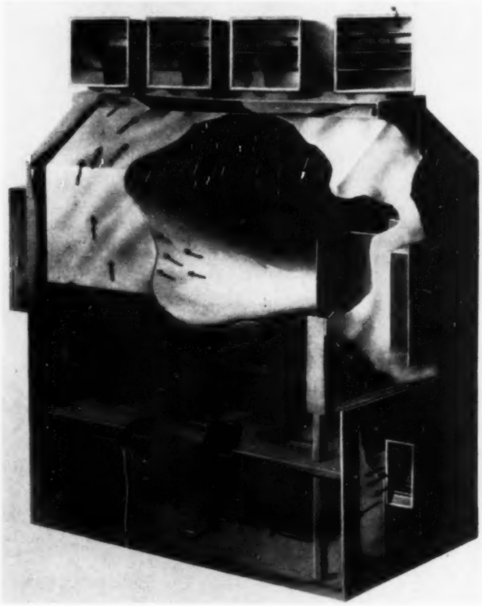
43. Pneumatic Core Truck

Engineered to prevent loss or damage of cores while in transit. Chicago Mfg. & Distributing Co.'s pneumatic core truck has extra cushion tires and special springs to assure safe core transport in the foundry.



44. Gating Strips

Specifically designed to perform the duties of gate and runner strips on pattern boards in less time and at a lower cost, Key Co.'s Rub-R-Gates are made to required sizes and can be applied to bottom boards and pattern boards in any desired curve.



45. Counter Flow Heater

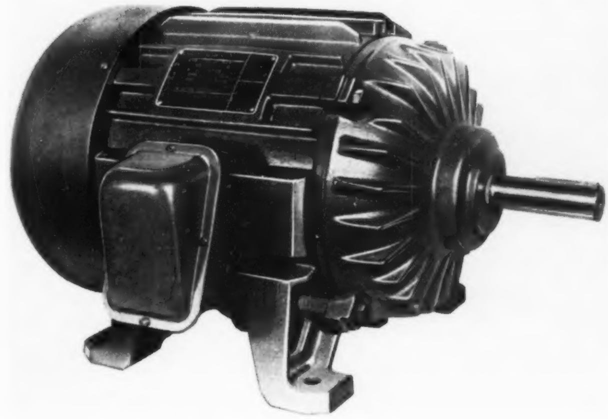
Fresh air brought into the foundry, heated and distributed by Dravo Corp.'s counterflow heaters, capable of handling from 4500 to 22,000 cfm, depending on size of fans and motors. Fuel and air are mixed electrically and flame is sent to rear of stainless steel combustion chamber. In counterflow motion, radiant flame returns to front of chamber, assuring more complete fuel combustion. Hot gases are then whirl-cooled in economizer tubes, and are exhausted through the vent stack at rate of 2000 fpm, distributing warm air over large work areas, with or without ductwork.

46. Casting Cleaning Cabinet

A new principle of modified impact blasting, involving an abrasive suspended in liquid, is embodied in Pangborn Corp.'s new line of hydro-finish cabinets. Extremely fine mesh abrasives can be used to blast clean precision machined parts, holding within tolerances as close as 0.0001 in. By varying particle size, hardness, air pressure, etc., almost an infinite number of finishes are possible. Hydro-finish cabinets are available in four sizes with floor spaces of 30 x 36, 48 x 36, 60 x 48, and 72 x 60 in., and ranging from 7 ft 10 in. to 10 ft 9 in. in height. Cabinets are watertight, with hopper tank for mixing, storing and collecting suspension.

48. Flask Sections

Rigidly constructed and light in weight to withstand squeeze in molding. Sterling Wheelbarrow Co.'s flask sections for multiple molding maintain pin centers at all times, have ample vent holes without weakening flask web. These rolled steel channel flasks insure correct pin and bushing clearances when worked with pattern plates.



47. Induction Motors

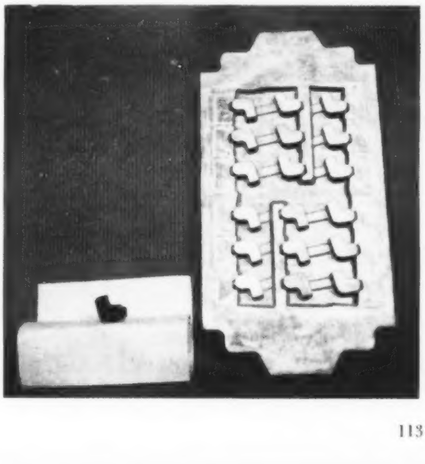
Newly-designed, totally-enclosed induction motors, including explosion-proof types, are announced by Allis-Chalmers Mfg. Co. in ratings of ½ to 7½ hp, 900 to 3600 rmp, in frame sizes 203 through 284 inclusive. Features include cast iron yokes and housings with external yoke ribs for strength, die-cast aluminum rotors, and five-year maintenance-free lubricated bearings.

49. Strainer Cores

Custom made AlSiMag strainer cores that are not affected by pouring and will not disintegrate or contaminate the castings have been developed by the American Lava Corp. Core material is not affected by heat shock, and after pouring remains in gate and is fluxed away in later remelting.

50. Roof Ventilator

Power-operated with dampers automatically opened by the air stream. Powermatic Ventilator Co.'s roof ventilator has propeller-type, vertically mounted fans that discharge air upward, where it cannot re-enter building. Manufactured in 15 sizes and capacities ranging from ¼ hp to 10 hp.



51. Matchplates

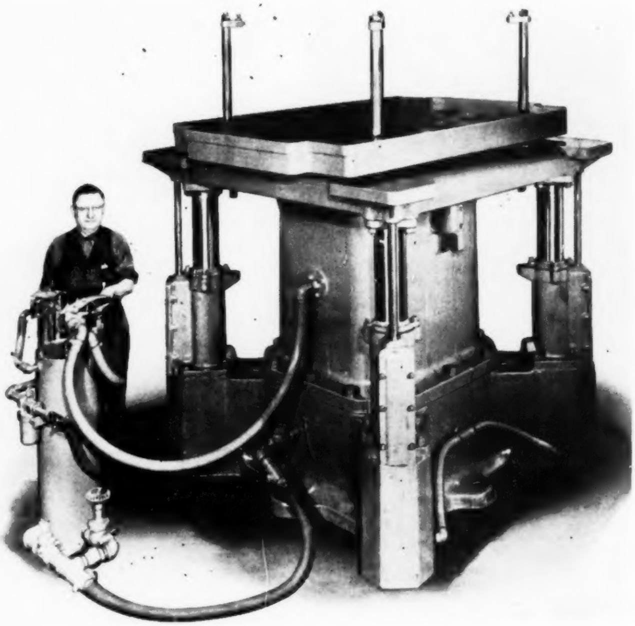
Advantages of pressure matchplates developed by the Pressure Match Plate Co., Inc. are: (1) only one master pattern required; (2) finer detail of design; (3) no shrinks or draws; (4) clean parting line; (5) lower cleaning costs. Illustrated is matchplate fully gated from one master pattern.

53. Fluxing Materials

The exclusive, pre-measured scored brick form of Cleveland Flux Co.'s metal cleanser reduces labor required for fluxing molten iron to a few seconds and eliminates digging out of container, weighing and measuring. Operator merely throws required number of bricks into cupola. Approximately one brick is required to clean a ton of iron. Scored brick feature permits breaking off sections for smaller charges. In solid brick form, this flux does not blow out with blast, instead remains in melting zone until consumed.

52. Foundry Goggles

American Optical Co.'s improved foundry goggles have choice of 50 mm super armorplate, 6 curve armorplate clear or Calobar lenses in three shades, with horsehide mask, adjustable headband, wire screen ventilators, corduroy bind.



54. Giant Jolt Pin Lifter

Believed to be the heaviest jolt pin lifter ever constructed, Milwaukee Foundry Equipment Co.'s giant new unit is designed to eliminate squaring shafts, linkages and cranks and is capable of handling a wide range of molding jobs, requiring only a pattern mounted on any type of plate. The lifter has true jolting action and precise, controlled pattern draw, and can be worked with a slinger where needed. Jolting capacity, with 18 in. jolt piston, is 10,000 lb at 90 psi line pressure. Hydraulic strip has 7000 lb capacity. Table size is 85 x 54 in. with 51 in. maximum and 38 in. minimum pin width.

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METALLOGRAPHY OF ALUMINUM CASTING ALLOYS

A. M. Montgomery
Head, Metallographic Dept.
Cleveland Research Div.
Aluminum Co. of America
Cleveland

MICROSCOPIC EXAMINATION of suitably polished and etched specimens of aluminum casting alloys enables the trained metallographist to determine many factors of commercial interest. The examination may reveal the method of casting (sand, permanent mold, or die casting), the type of alloy, the type and extent of heat treatment, the grain size, the presence of voids, inclusions or segregation, the type and thickness of surface coatings, the type and extent of corrosion, or the type of fracture in a casting failure.

Each of these applications of the metallography of aluminum casting alloys is described following a discussion of the selection of specimens and the various polishing operations. Typical micrographs of the common aluminum casting alloys with the constituents identified are included.

Selecting Specimens

In the metallographic examination of an aluminum casting, the selection of representative specimens is most important. For example, in a casting composed of sections that vary in thickness, it may be necessary to examine a specimen from each section in order to evaluate the entire casting. Also, knowledge of the approximate stresses to which the casting will be subjected in service is helpful in the selection of specimens from the more highly stressed or critical areas.

Chilled regions or sections near gates or risers generally exhibit structural characteristics that are not typical of the complete casting. In some cases, however, it is desired to investigate these localized regions. Exploratory radiographic examination is helpful in selecting preferred locations for the removal of metallographic specimens. Preliminary inspection by means of fluorescent penetrating oil is useful in revealing surface cracks.

Specimens should preferably be removed from castings by sawing. Hammering or use of considerable force should be avoided since drastic distortion of the microstructure may result. The specimen size should not be unnecessarily large, for as the size of the polished surface increases the attainment of a suitable polish becomes more difficult. A specimen ½ x ½ x ¼ in. can be prepared easily and rapidly.

Polishing — Etching Metallographic Specimens

Recommended polishing and etching practices for aluminum alloys have been thoroughly described by F. Keller (1948 edition, ASM *Metals Handbook*).

Preprint No. 49-13. This paper will be presented at an Aluminum and Magnesium Session of the 53rd Annual Meeting, American Foundrymen's Society, at St. Louis, May 2-5, 1949.

Small or irregular specimens or those with a surface coating should be mounted in plastic. Bakelite or lucite are satisfactory, and may be used in the various metallurgical mounting presses that are available. The manufacturers' recommendations should be followed to produce uniformly mounted specimens. The specimen is first filed flat to remove any metal distorted by the sawing operation. It is then ground successively on 180-grain aloxite paper or 120 emery cloth, No. 1 metallographic paper, and No. 3/0 paper, using kerosene as a lubricant in each case.

Between the successive grinding stages, the specimen should be carefully cleaned to prevent carry-over of coarse abrasive grains. It should also be rotated 90° to the direction of the preceding grinding marks. After the kerosene is removed from the ground specimen, polishing is begun on a broadcloth or gamal-cloth wheel using a water suspension of 600 alundum flour as an abrasive. Polishing is continued for twice as long as is necessary to remove the grinding marks from the No. 3/0 paper in order to insure the removal of distorted metal.

After washing with soap and water, the specimen is transferred to the final wheel which is covered with broadcloth, gamal-cloth, or velvet. A fine polish is produced using a paste of heavy magnesium oxide in distilled water as an abrasive. The pressure and speed of the wheel are gradually diminished as polishing proceeds. When all obvious scratches have been removed and the specimen has a uniformly specular appearance, it is washed under hot tap water and blown dry.

The specimen may be examined in the as-polished condition for voids, inclusions, or segregation. It is then usually etched by swabbing or by immersion to remove the last traces of flowed metal from the polishing operation and to reveal details of the microstructure. •A solution of 0.5 per cent HF in water is the most common swab etching reagent, while Keller's etch (1 ml HF, 1½ ml HCl, 2½ ml HNO_3, 95 ml H_2O) is the most common immersion etchant.

Intermediate Polishing Is Important

It should be emphasized that for aluminum casting alloys the intermediate polishing operation on the cloth wheel with 600 alundum flour should be carefully performed. Somewhat more time and heavier pressure should be used in polishing cast alloys than wrought alloys on this wheel.

If these procedures are not followed voids may not be revealed, and erroneous interpretations may result. Thus, in the past, numerous micrographs have shown lines identified as "dross films" which were actually voids that had not been uncovered during this intermediate polishing stage. A simple test for determining the nature of such lines consists of pressing the surrounding material with a needle while viewing the operation under the microscope. If the layer over the

voids collapses under pressure from the needle, the line is not a dross film.

Macroscopic examination of sections of aluminum alloy castings is useful in revealing voids, grain size and shape, segregation, and inclusions. Surface preparation is generally limited to grinding on a belt sander, or machining to a smooth, uniform surface on a lathe or shaper. For somewhat better results, these procedures may be followed by a commercial buffing operation, although buffing may be accompanied by marked surface flow. The section is then etched by immersion, swabbing, or pouring the etching reagent over the prepared surface.

Macro etchants are generally strong solutions of caustic or mineral acids, and therefore the temperature and time of etching must be closely controlled to prevent overetching. A 10 per cent sodium hydroxide-water solution at 150 F is a good general macro etching reagent. With copper-containing alloys, it is necessary to swab or immerse an etched specimen with concentrated nitric acid to remove the black copper etching residue. The specimen should then be washed with hot water and blown dry.

Voids may be revealed by the grinding or machining operation alone, although etching usually aids in the detection by the removal of embedded chips. Nonmetallic inclusions may also be apparent without etching since they are generally harder than the matrix and stand in relief. The detection of segregation is facilitated by etching since the segregate will have different etching characteristics than the matrix. The procedure required for the macroscopic determination of grain size depends on the size of the grains—the finer the grains, the more careful must be the grinding or machining preparation.

Structure of Casting Alloys

Most commercial aluminum casting alloys consist of hypo-eutectic structures in which aluminum solid solution dendrites are the matrix. Upon etching, these primary dendrites often show coring in the as-cast condition as revealed by a different etching rate of the periphery of the dendrites compared with the center. Binary and ternary eutectics are distributed around the dendrites and form the remainder of the structure.

These eutectics are always of the "divorced" type in commercial aluminum casting alloys; that is, the eutectics consist of discrete particles of the alloying element or the intermediate phase and the surrounding aluminum solid solution, rather than the pearlitic structure characteristics of eutectics in richer alloys. The aluminum solid solution part of the eutectic blends into the primary aluminum solid solution without any noticeable boundary.

Alloying additions may appear as elements containing some aluminum in solid solution (Si), (Sn), (Pb), or as intermediate phases of one or more elements with aluminum (Al-Cu), alpha (Al-Fe-Si), or as intermediate phases of alloying elements without aluminum (Mg-Si), alpha (Ca-Si).

Effect of Solidification Rate

The solidification rate of aluminum castings is reflected by the microstructure. As the solidification rate increases, the size of the dendrite cells (the cross section of the dendrite branches) decreases, the constituent size is reduced, and generally the grain size diminishes. However, grain size is not always a reliable criterion of solidification rate since it is also affected by the presence of grain refiners.

In addition to these effects, the size of gas porosity decreases with increasing solidification rate. By examination of the microstructure and comparison with standard specimens, therefore, it is possible to determine whether a specific casting was sand cast, permanent mold cast, or die cast since these three methods of casting represent appreciably different rates of solidification.

Identifying Alloy Type

Alloy types may be determined from the identities and quantities of the constituents present provided the solid solubility of an alloying element is exceeded and the element is represented by a distinctive constituent. Thus, in a specimen of an aluminum-copper alloy, the quantity of (Al-Cu) constituent present is a direct function of the weight percentage of copper in the alloy.

Similarly, the quantity of (Si) in an aluminum-silicon alloy is a function of the weight percentage of silicon. Each constituent has a different specific volume and solid solubility, however, so that microscopic fields containing equal areas of (Al-Cu) and (Si) are indicative of unequal weight percentages of copper and silicon in the alloys. Estimation of the weight percentage of an alloying element, therefore, necessitates comparison with specimens of known composition. Identification of alloy type by this method is applicable to practically all commercial aluminum casting alloys.

The type and extent of heat treatment may be determined from the appearance and quantity of those constituents which are known to be soluble at elevated temperatures. A solution heat treatment generally dissolves most of the soluble constituents present in the as-cast condition and thus increases the continuity of the aluminum solid solution matrix. Coring of the dendrites is eliminated or at least greatly reduced. Even the "insoluble" constituents remaining after solution heat treatment may show some slight solubility as evidenced by the rounding of the corners of normally angular particles.

Heat Treatment Effects

A solution heat-treated alloy has marked grain contrast when compared to the as-cast material. That is, if a polished specimen is etched with a reagent that attacks or colors each grain at a rate depending on its orientation, the contrast in attack or color between adjacent grains is at a maximum in the solution heat-treated condition. Evidence that an excessively high heat-treating temperature, resulting in incipient melting, has been employed is provided by the presence of intergranular deposits of fine eutectic constituent particles, or of round intra-granular "rosettes" of eutectic.

It is difficult and sometimes impossible to distinguish microscopically between solution heat-treated castings and those similarly treated but subsequently artificially aged. The major difference between such specimens is the reduced grain contrast in the latter. The parti-

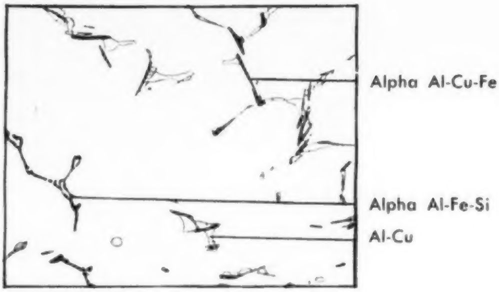


Fig. 1—Sand-cast alloy 112. Two-step etching distinguishes black iron constituents, Chinese script alpha Al-Fe-Si and needles of alpha Al-Cu-Fe, from rounded, white Al-Cu. Etched in 20 per cent H_2SO_4 at 70 C for 30 sec followed by 0.5 per cent HF etch. X250.

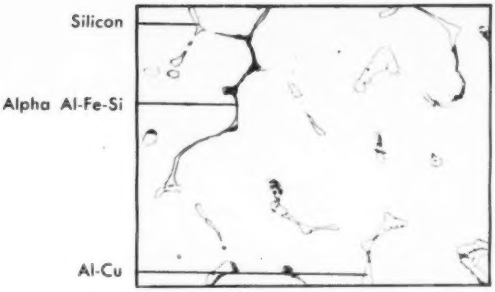


Fig. 2—Sand-cast alloy 212. Two-step etching distinguishes black alpha Al-Fe-Si from gray Si and white Al-Cu. Rounded lacy areas associated with Al-Cu are ternary eutectic. Etched in 20 per cent H_2SO_4 at 70 C for 30 sec followed 0.5 per cent HF etch. X250.

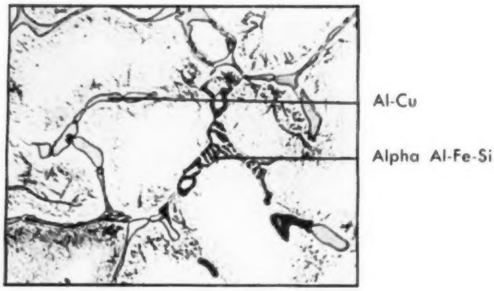


Fig. 3—Sand-cast alloy 195-F. Almost continuous interdendritic network of Al-Cu and alpha Al-Fe-Si surrounding cored aluminum solid solution dendrites. Coring is indicated by precipitated Al-Cu in the shaded areas. Keller's etch. X250.

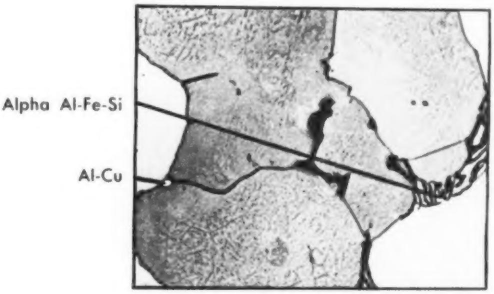


Fig. 4—Solution heat treated sand-cast alloy 195-T6. Heat treatment has dissolved practically all Al-Cu and eliminated coring. "Chinese script" alpha Al-Fe-Si is unchanged. Keller's etch. X250.

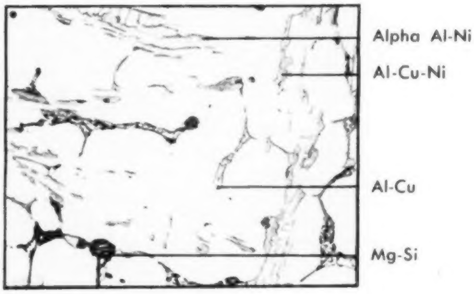


Fig. 5—Sand-cast alloy 142-F. Complex constituent network of Al-Cu, Mg-Si, Al-Cu-Ni, and alpha Al-Ni. The alpha Al-Ni penetrates the aluminum solid solution dendrites indicating that it formed early in the solidification process, before the other constituents. Etched in 0.5 per cent HF. X250.

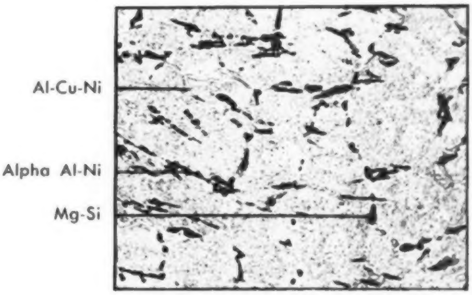


Fig 6—Solution heat treated and stabilized sand-cast alloy 142-T77. Heat treatment has successively dissolved and precipitated the soluble Al-Cu and Mg-Si. The alpha Al-Ni etches darker and the Al-Cu-Ni is slightly rounder. Etched in 0.5 per cent HF. X250.

cles formed during these aging treatments are usually submicroscopic in size. When a stabilizing treatment or a long-time aging treatment is applied, the precipitate particles may become visible. An annealing treatment results in coarse, well-formed particles.

Determining Grain Size

Grain size of aluminum alloy castings can be measured approximately by visual comparison of polished and etched specimens with photographs or specimens of known grain size. A somewhat more accurate and convenient method consists of inscribing a line of known length on a polished and etched specimen and counting the number of grains intersected by the line, using a low-power microscope or hand glass. The length of the line is divided by the number of grains to yield an average grain diameter in inches per grain.

A still more precise but less convenient method consists of counting the number of grains in a circle of known diameter at a magnification of X50 orX100 and expressing the grain size in grains per unit area.

Table 1 — Nominal Composition of Alloys Illustrated in Photomicrographs (Figs. 1-16).

Commercial Alloy No.	ASTM No.		Composition, per cent						
	Present	Former	Cu	Si	Mg	Zn	Ni	Cr	Ti
112	CS22	C	7.0	—	—	1.7	—	—	—
212	—	CC	8.0	1.2	—	—	—	—	—
195	C1	G	4.5	0.8	—	—	—	—	—
142	CN21	H	4.0	—	1.5	—	2.0	—	—
122	CG1	F	10.0	—	0.2	—	—	—	—
43	S1	JJ	—	5.0	—	—	—	—	—
355	SC21	N	1.3	5.0	0.5	—	—	—	—
356	SG1	M	—	7.0	0.3	—	—	—	—
319	SC8	—	3.5	6.3	—	—	—	—	—
214	G1	L	—	—	3.8	—	—	—	—
220	G3	—	—	—	10.0	—	—	—	—
40E	ZG41	O	—	—	0.5	5.25	—	0.5	0.2

The typical grain size diameter of permanent mold castings is from 0.01 to 0.05 in. Grains in sand castings generally vary in diameter from 0.01 to 0.2 in. although coarser grains may be occasionally encountered.

Detecting Voids — Inclusions — Segregation

The general term "void" has been used to include a number of discontinuities of various origins. Gas porosity, shrinkage porosity, entrapped gas holes, and cracks are the most prevalent types of voids in aluminum castings. Entrapped gas holes may be recognized by their spherical shape and coarse size. Cracks are, of course, characterized by their shape.

Aluminum alloy castings almost invariably contain some gas porosity. When present in relatively large quantity, gas porosity commonly appears as spherical voids. However, gas porosity usually assumes an interdendritic shape because the voids are formed after solidification of the alloy has started. Thus it is sometimes difficult to distinguish gas from shrinkage porosity which always has interdendritic appearance.

The best criterion for distinguishing gas porosity from shrinkage is the distribution of the voids. Gas porosity is more uniformly distributed throughout a casting whereas shrinkage porosity is concentrated in regions which are poorly fed. Radiographic examination, therefore, has the advantage over metallography for determining the type of porosity in a casting since a more general, over-all appraisal is obtained.

Inclusions are occasionally found in aluminum alloy castings as coarse discrete particles, or as thin films of non-metallics consisting chiefly of aluminum oxide. They may be detected visually on polished metallographic specimens since they stand in relief and cause drag marks on polishing. Microscopically, inclusions generally appear black under normal incident illumination. Since they are present in the melt before solidification occurs, the surrounding microstructure in the solid casting will conform to the shape of the inclusions rather than vice versa.

Segregation may be detected in metallographic specimens as larger than normal concentrations of alloying constituents. Segregation is usually associated with hot cracks, shrinkage, or liquation.

Surface Coatings

Aluminum alloy castings are usually supplied without surface coatings. However, some castings may be given an electrolytic oxide coating or may be painted or electroplated, etc.

Surface coatings are best examined by mounting a cross section in plastic. Amber bakelite is an excellent mounting material since it forms an adherent bond with the specimen that resists breaking during grinding. Coating thickness measurements may be made by a direct reading filar ocular or by projecting an image of the coating on the ground glass screen and measuring the image. Paint coatings appear opaque, colored, and lamellated under dark field illumination.

Electrolytic oxide coatings are translucent in dark field and are also characterized by the protrusion of constituents into the coating since the coating is formed by oxidation of the aluminum portion of the surface while the constituents are generally unattacked. Surface coatings of electro-deposited metals are obviously characterized by their metallic appearance under the microscope and frequently by a columnar structure normal to the plated surface.

Corrosion is not a serious factor in the service life of castings since the heavy section size characteristic of castings generally precludes the possibility of failure by corrosion. Occasionally, however, the appearance of castings may be impaired by corrosion.

Types of corrosion in aluminum alloy castings may be divided into three groups—pitting, intergranular,

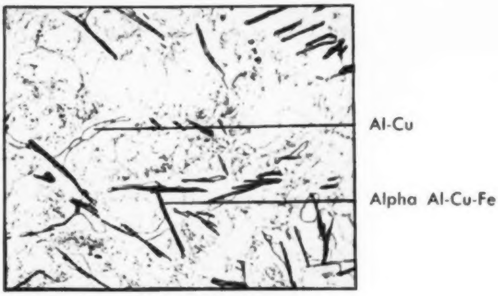


Fig. 7—Sand-cast alloy 122-F. Large quantity of Al-Cu closely associated with needles of alpha Al-Cu-Fe. Dendrites contain percipitate of Al-Cu. Etched in 20 per cent H_2SO_4 at 70 C for 30 sec followed by 0.5 per cent HF etch. X250.

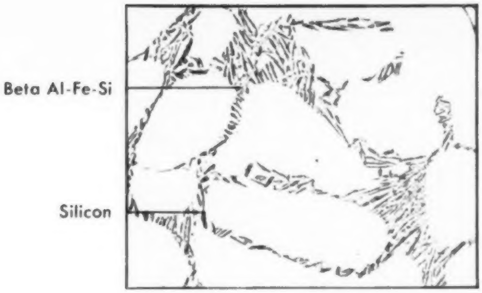


Fig. 8—Sand-cast alloy 43. Interdendritic network of Si with associated needles of beta Al-Fe-Si. Etched in 0.5 per cent HF. X250.

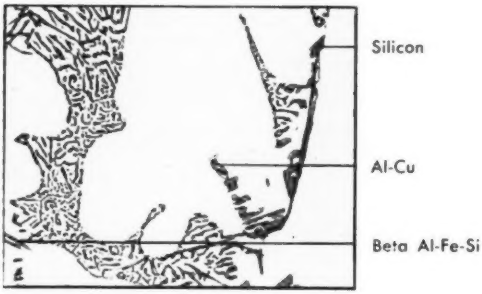


Fig. 9—Sand-cast alloy 355-F. Interdendritic network of Si, Al-Cu, and beta Al-Fe-Si. Etched in 0.5 per cent HF. X250.

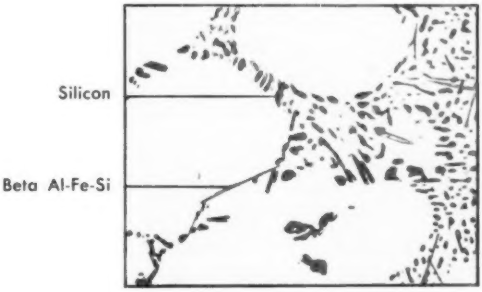


Fig. 10—Solution heat treated sand-cast alloy 355-T6. The Al-Cu has been dissolved, Si has been spheroidized, and beta Al-Fe-Si has not been changed by heat treatment. Etched in 0.5 per cent HF. X250.

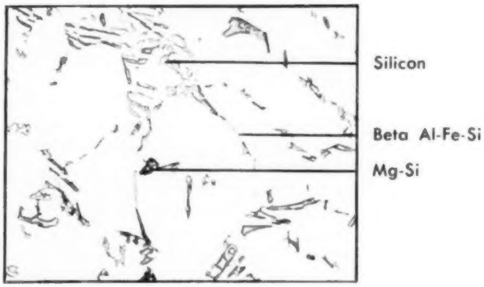


Fig. 11—Sand-cast alloy 356-F. Interdendritic network of Si with small quantities of Mg-Si and Al-Fe-Si. Solution heat treatment will dissolve the Mg-Si and partially spheroidize the Si particles. Etched in 0.5 per cent HF. X250.

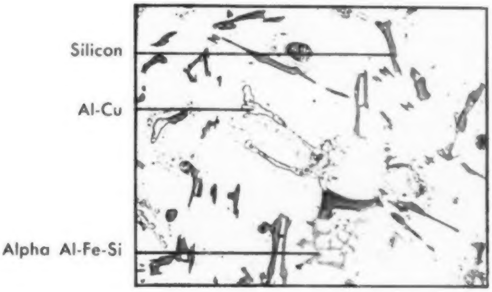


Fig. 12—Sand-cast alloy 319-F. Angular, gray Si; rounded, white Al-Cu; script-like, gray alpha Al-Fe-Si; and rosettes of ternary eutectic. Etched in 0.5 per cent HF. X250.

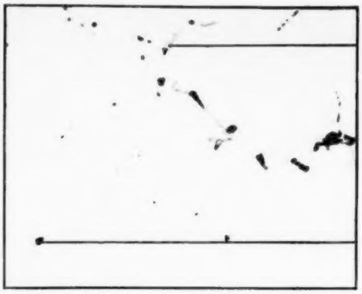


Fig. 13—Sand-cast alloy 214. Primarily a solid solution type alloy with only small quantities of Mg-Si and alpha Al-Fe along the grain boundaries. Etched in 0.5 per cent HF. X250.

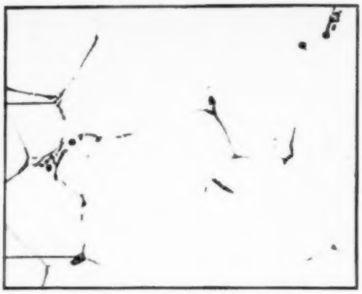


Fig. 14—Sand-cast alloy 40E. Another solid solution alloy with only small quantities of intergranular Mg-Si and alpha Al-Fe-Si. Keller's etch. X250.

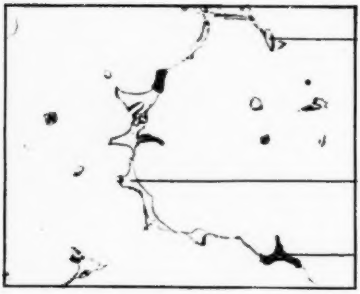


Fig. 15—Sand-cast alloy 220-F. Intergranular and interdendritic network of alpha Al-Mg with small quantities of associated Mg-Si and alpha Al-Fe. Etched in 0.5 per cent HF. X250.

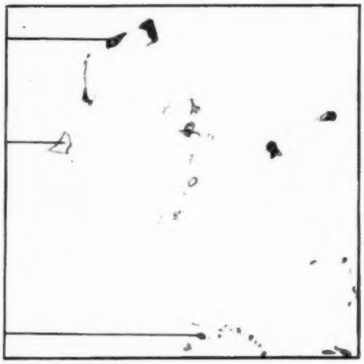


Fig. 16—Solution heat treated sand-cast alloy 220-T4. Heat treatment has dissolved practically all the alpha Al-Mg and rounded the Mg-Si. The alpha Al-Fe is unchanged. Etched in 0.5 per cent HF. X250.

and intragranular. Pitting corrosion exhibits no preference as to its method of attack on a microstructure. It proceeds intergranularly at the same rate as intragranularly with the result that simple, smooth-walled pits are formed. Intergranular corrosion, on the other hand, proceeds principally along grain boundaries to an extent that it may form a network of corrosion enveloping the grains.

Intragranular corrosion includes several types of attack in which the corrosion may show a preferential attack on the aluminum solid solution dendrites, or between constituents and the matrix within a grain. Stress corrosion is a rarely encountered intergranular attack which is accentuated by tensile stresses. Stress corrosion is generally confined to a relatively few intergranular stringers that proceed perpendicular to the direction of the stress. A metallographic examination of corrosion in castings should include determinations of the depth of penetration, the type of attack, and the relative order of attack if several types are present.

Occasionally castings are underdesigned or overloaded in service with the result that failure may occur. Such failures may exhibit either a tensile or a fatigue type of fracture. A tensile failure indicates that the casting has been loaded excessively. The resulting fracture will progress in an erratic manner through the microstructure, proceeding along the interdendritic eutectic network or through the aluminum solid solution and exhibiting no preference.

Fatigue fractures, on the other hand, are chiefly confined to the solid solution and to certain crystallographic planes therein. As a result, fatigue fractures have a jagged, lightninglike appearance under the microscope caused by the fracture proceeding from one crystallographic plane to a parallel plane in the same grain. Macroscopically, fatigue fractures have a crystalline appearance with facets proportional to the grain size and generally exhibiting "oyster shell" curved progression lines concentric with the nucleus of the failure.

Representative photomicrographs of the common aluminum casting alloys are given in Figs. 1-16. These illustrations are typical of sand-cast ½ in. thick sections of alloys of nominal composition cast at commer-

TABLE 2—MAJOR CONSTITUENTS OF ALLOYS ILLUSTRATED IN PHOTOMICROGRAPHS

Commercial Alloy No.	Major Constituents.
112	(Al-Cu), α (Al-Cu-Fe), α (Al-Fe-Si)
212	(Al-Cu), (Si), α (Al-Fe-Si)
195	(Al-Cu), α (Al-Fe-Si)
142	α (Al-Ni), (Mg-Si), (Al-Cu-Ni), (Al-Cu)
122	(Al-Cu), α (Al-Cu-Fe)
43	(Si), β (Al-Fe-Si)
355	(Si), β (Al-Fe-Si), (Al-Cu)
356	(Si), β (Al-Fe-Si), (Mg-Si)
319	(Si), (Al-Cu), α (Al-Fe-Si)
214	(Mg-Si), α (Al-Fe)
220	α (Al-Mg), (Mg-Si), α (Al-Fe)
40E	(Mg-Si), α (Al-Fe-Si)

cial casting temperatures. The nominal compositions of the alloys are listed in Table 1. The major constituents are indicated on the micrographs and also are listed in Table 2. Micrographs showing the effect of solution heat treatment on an aluminum-copper, an aluminum-copper-magnesium-nickel, an aluminum-silicon-magnesium, and an aluminum-magnesium alloy are also included.

The micrographs of Figs. 1-16 were made at a magnification of X250, not only to obtain a general view of the microstructure including the size, distribution, and quantity of constituents and the size of aluminum solid solution dendrites, but to identify the constituents as well. In practice, other magnifications are also used, ranging from X100 for general examination to X500 for identification of constituents.

Typical Microstructures of Sand Cast Aluminum Alloys

Examination of these micrographs will enable metallographists who are not familiar with the structures of aluminum casting alloys to determine if the composition of a specimen of an alloy is approximately correct by a comparison of the type and quantity of the constituents present in the specimen and in the corresponding micrograph. Thus the presence of larger needles, beta (Al-Fe-Si), than those in the micrograph of alloy 43 (Fig. 8), may indicate an excessive iron content.

The micrographs illustrate a specific section size (½ in.) and a particular commercial pouring temperature. As explained previously, when the section size or pouring temperature increases, the solidification rate decreases and the solid solution dendrites as well as the constituents become coarser. Thus an indication of the pouring temperature of a ½ in. thick casting may be obtained by comparing its microstructure with the micrograph of the corresponding alloy. A coarser structure than that of the micrograph will indicate a higher pouring temperature.

Micrographs demonstrating the effects of solution heat treatment may be used to estimate the degree of heat treatment in a specimen. This may be deduced from the quantities of the soluble constituents remaining after solution heat treatment in alloys 142, 195, 220 and 355 which show practically complete solution heat treatments in all cases.

An incomplete solution heat treatment will be indicated, therefore, by the presence of more than the few small undissolved particles of soluble constituents indicated in these micrographs. This does not strictly apply to castings that have solidified more slowly than the ½ in. sections illustrated in Figs. 1-16. Such castings may exhibit somewhat more but still only a small quantity of undissolved constituents after being subjected to the standard solution heat treatment.

Summary

Metallographic examination is but one of a number of means of examining aluminum alloy castings that are available to the metallurgist. Like other methods, it supplies certain specific information unobtainable in any other way. Unlike other methods, it may be used, in addition, to yield a variety of general information depending on the skill and experience of the metallographist. It is hoped that this article will contribute to both fields of information.

Chicago Foundry Executives Form Air Pollution Reduction Committee

CHICAGO'S AIR POLLUTION PROBLEM, long one of the worst in the United States, is being overcome by the cooperative efforts of the City's industrial executives, members of the Chicago Association of Commerce and Industry.

Latest group to be formed within the Association which includes industrialists of every type, is the foundry executives' subcommittee for cleaner air. Chairman of the subcommittee is James R. Allan, International Harvester Co., former chairman of the A.F.S. Safety and Hygiene Committee, during the period when that committee prepared the widely-used A.F.S. Safety and Hygiene Codes.

Committee members include S. C. Massari, technical director, American Foundrymen's Society; L. H. Rudesill, Griffin Wheel Co., chairman of the gray iron subgroup; F. B. Skeates, Link-Belt Co., converter steel subgroup; W. W. Moore, Burnside Steel Foundry Co., electric furnace subgroup; Chris Heise, International Harvester Co., malleable iron subgroup; C. S. Detlefsen, Crane Co.; Frank O'Neill, Western Foundry Co.; and L. P. Vasser, International Harvester Co.

Purpose of the committee will be to curb that part of Chicago's air pollution contributed by the City's foundries, and, according to Chairman Allan "the first assignment is to learn how best to operate the equipment we have, before attempting to explore the uses of additional devices."

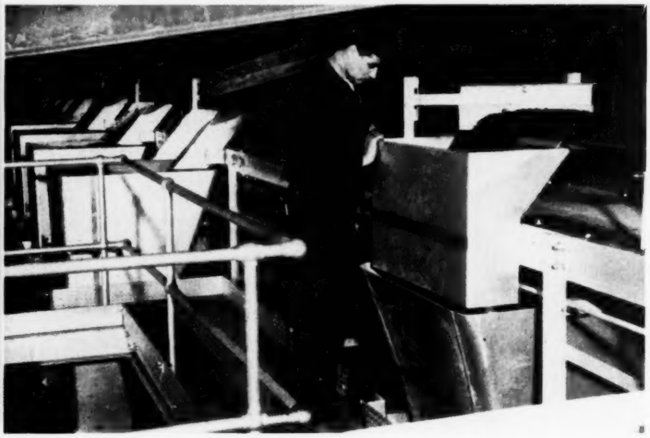
California A.F.S. Chapter Sponsors Junior College Metallurgy Course

SPONSORED JOINTLY by the Southern California Chapters of the American Foundrymen's Society and the American Society for Metals, a practical shop course in metallurgical materials and methods is being given Monday evenings, January 31 to June 17, at the East Los Angeles Junior College.

Held under the direction of E. K. Smith, Los Angeles metallurgical consultant, and other specialists in metallurgy from the Los Angeles area, the course deals with metallurgical processing in the foundry, metal manufacturing and fabricating industries.

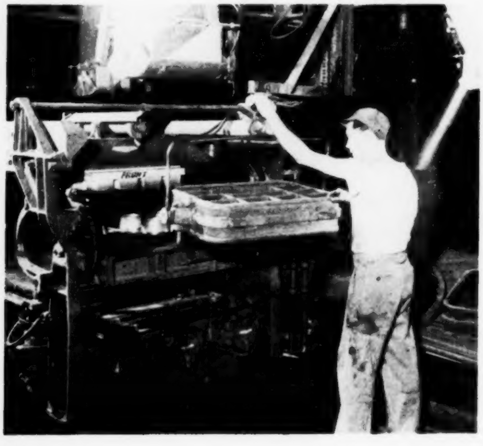
MODERN FOUNDRY METHODS

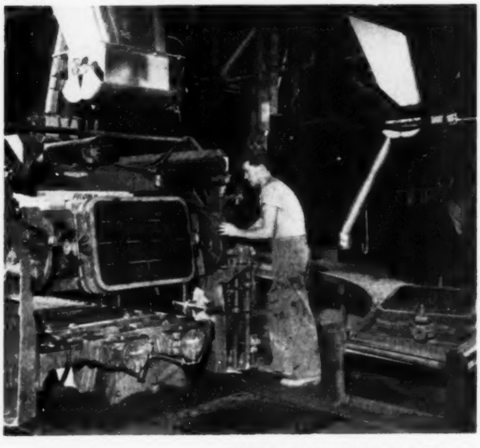
The Westinghouse Electric Corp. foundry, at East Springfield, Mass., is part of the Electric Appliance Div. of the company. Nearly every appliance made uses a gray iron casting—fan bases and motor housings, compressor housings, etc. The appliance plant manufactures large quantities of each of its several products, and the recently mechanized foundry was designed for high production of highly repetitive small castings. Gray iron castings are produced in considerable quantity—40,000 to 60,000 lb daily. Examples of the castings produced are shown at the right.



An overhead conveyor is used in the sand handling system. After passing through the perforated shakeout the sand runs over a magnetic pulley, and is then carried by an elevator to a vibrating screen which removes cores and lumps. From here the sand is carried by conveyor to a 250-ton hot sand storage bin. Two mixers, located directly underneath the storage bin, mix the sand with new sand, clay and water. The mixed sand is discharged to a conveyor which carries it to a sand conditioner. From the conditioner the sand is carried by conveyors to hoppers (left) above the various molding stations.

Jolt-squeeze-rollover machines (below) are used for making drag molds for motor housing castings. The molder picks up an empty drag with an air hoist from the gravity roller





... MODERN FOUNDRY METHODS

conveyor which returns copes and drags from the shakeout. The drag is placed over the pattern on the molding machine and filled with sand from an overhead hopper. After jolting and squeezing the machine turns the drag over, vibrates it, and draws the pattern.

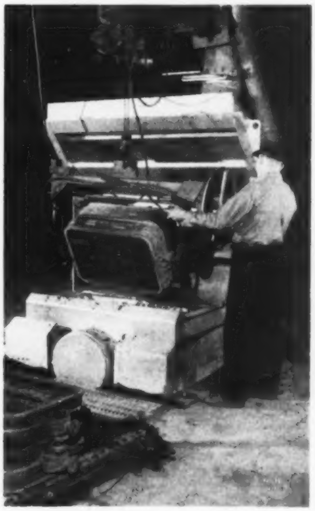
Copes are handled from the return gravity conveyor by air hoist to the molding machine, operated on 80-lb air pressure and supplied with sand from an overhead hopper. The machine jolts the cope, scrapes off excess sand, squeezes the sand down, vibrates pattern and strips pattern all in one automatic sequenced cycle. The molder picks up the cope mold with an air hoist and places it on the drag mold. The flask is then pushed down the roller conveyor to an air-operated transfer car (below) which moves the mold to position in line with the outgoing roller conveyor to the pouring lines.

Molds are moved into position on the pouring line by an hydraulically actuated piston built in the transfer car. Air-operated clamping plates hold cope down on drag during pouring operation. Molds are poured from a 1000-lb capacity, insulated, geared ladle transported from cupola to pouring line on a tramrail.

When the molds come off the pouring line to the shakeout (right below) they are picked up by an electric jib crane, with a specially designed lifting and rollover bail or yoke, and placed over the ventilated vibrating shakeout. The hot sand and casting are discharged to an oscillating conveyor below, which transports them to a 4x8 ft perforated, vibrating shakeout. The sand falls through the perforations to the return conveyor below while the castings slide into a loading chute for the trolley conveyor.

The castings are transported by the trolley conveyor to the area adjacent to the cupola-charging operations, where the gates, sprues, and risers are removed. These are weighed into predetermined cupola batches and transported to the cupola-charging position by a 2-ton capacity automatic monorail system.

After shakeout the empty flasks are swung by the jib crane to the ramp (above) leading to the gravity roller conveyor. The flask is pushed up the ramp by an air cylinder to the gravity roller conveyor on which it returns to the molding positions.



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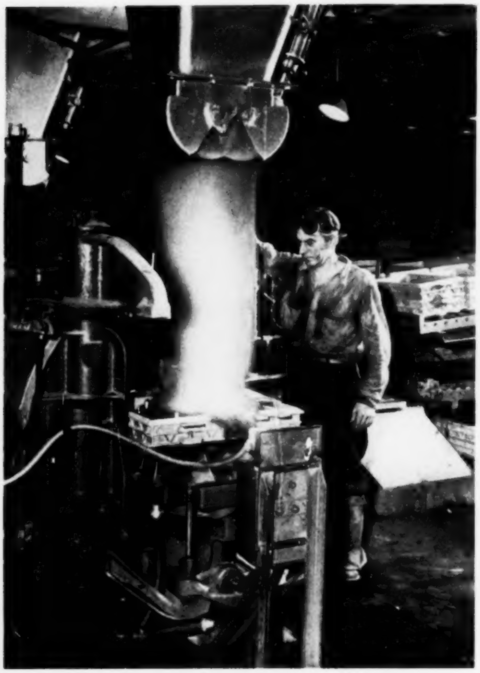
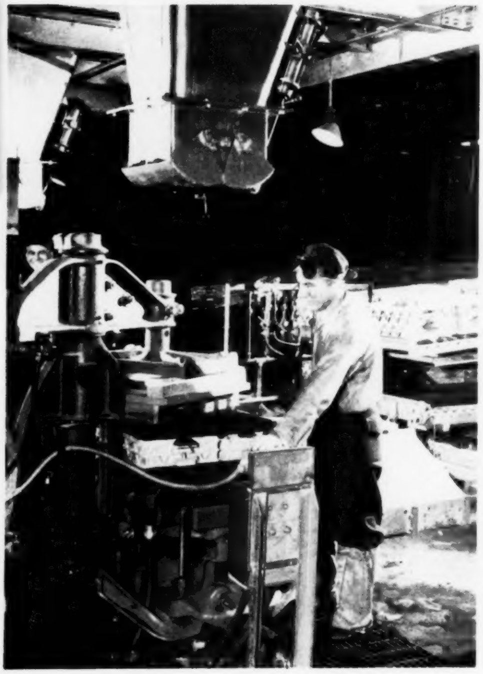


In this operation both cope and drag are molded at the same time, the molding machine being large enough to accommodate both cope and drag patterns. Sand is supplied from an overhead hopper with air-operated gate. The molding machine (left and above) jolts the cope and drag, scrapes off the excess sand, squeezes the sand down, vibrates and strips the patterns, all in one automatic sequenced cycle. The molder removes the drag from the molding machine (the drag is turned over on a spring hinge as it is removed from the machine) and places it on the outgoing roller conveyor. He then sets the cores. The completed mold is pushed along the roller conveyor that constitutes the pouring line by an air-actuated piston.

To conserve floor space the roller conveyor used for the pouring line is a three-decker (below). The two lower



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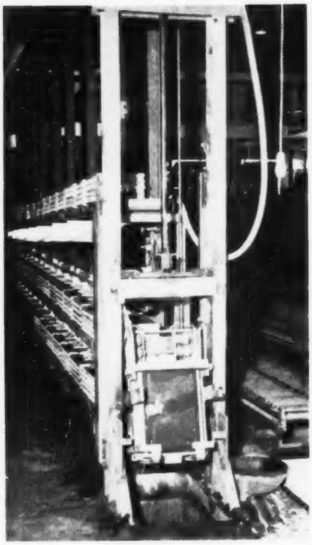


tiers are for outgoing flasks; the top tier for returning empty flasks. Air-operated clamping plates are controlled from one point.

Molds are poured from a 500-lb ladle (below) which is suspended from a monorail system and moved manually along the pouring line. After the molds have been poured, they are moved into shakeout position as new molds are placed on the conveyor and pushed into pouring positions.

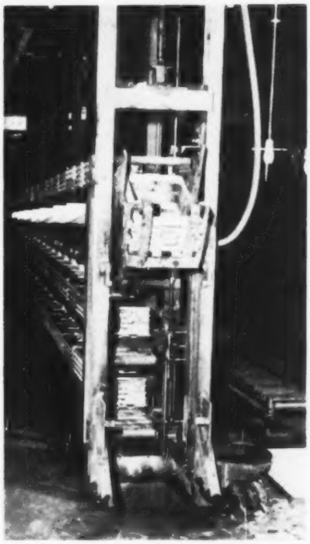
Operation of the shakeout is unique. At the end of the pouring conveyor line the poured mold rolls into a basket (left) that is supported on trunnions slightly off-center. When the basket hits the stop the weight of the mold causes the basket to turn over with sufficient velocity to discharge the hot sand and the casting onto an oscillating conveyor below.

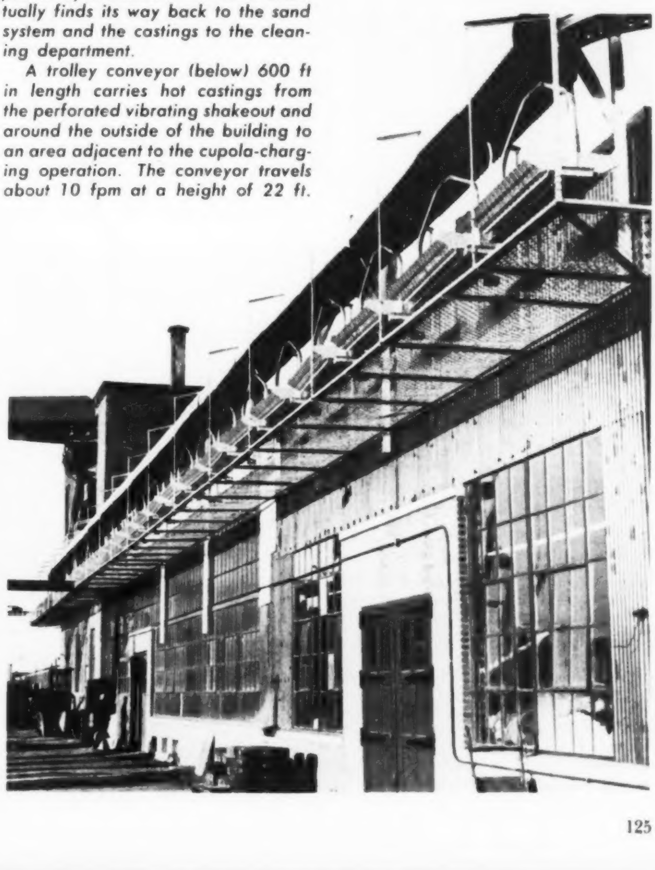
An air-actuated piston rod automatically raises the basket vertically to the top tier conveyor (right). The basket is righted while being raised, and the empty aluminum flask is unloaded onto the gravity roller conveyor for return to the molding stations.

No bottom boards are used. The flasks are equipped with grids in the drag half to hold the sand, thereby eliminating the need of bottom boards.

From the shakeout the hot sand and castings are handled in the same manner as the larger housing castings previously described—the sand eventually finds its way back to the sand system and the castings to the cleaning department.

A trolley conveyor (below) 600 ft in length carries hot castings from the perforated vibrating shakeout and around the outside of the building to an area adjacent to the cupola-charging operation. The conveyor travels about 10 fpm at a height of 22 ft.





FAST ANALYSIS OF ACID SLAGS

Reflective Spectrophotometry Determines FeO-MnO-Cr

E. C. Zuppann*
and
A. E. Martin**

Adapted from the M.S. thesis of Edward C. Zuppann, presented to the University of Minnesota in June, 1947, this paper describes the development of a rapid method for determination of FeO, MnO and Cr in acid slags. A finely ground slag sample is mixed with oil and examined in the reflecting attachment of a standard spectrophotometer at a few key wave lengths. Reflective densities determined are translated into percentages of FeO, MnO and Cr by reference to graphs.

For many years acid steelmakers have been searching for a fast, accurate method of determining the FeO content of slags as an aid in control of the acid steelmaking process. With a fast electric furnace the time from melt to tap is often less than one hour, and in this time the FeO content of the slag may change from 35 to 10 per cent. Obviously, if the analysis is to be of any value in the control of the process it must be rapid.

The only accurate method which has been available in the past is chemical analysis, which is much too slow for control purposes. For example, a fast method for total iron determination takes more than 25 min. and an FeO analysis requires an hour.

Two rapid methods, fluidity testing[1] and visual color[2] examination, have been used to a considerable extent, but they are quite inaccurate. The fluidity test[3,4] has been fairly successful in the determination of SiO_2. There seemed little reason to believe it could be developed further to produce accurate results for FeO. The color method, however, seemed to merit a more thorough examination. As previously carried out, the method involves the visual examination of the fracture and surface color of solidified slag specimens[2].

The moderate success achieved with this method has generally been considered as evidence that FeO is the dominant coloring agent in acid slags. On the other hand, its apparently inherent inaccuracy has been attributed to the presence of other coloring agents, probably MnO and Cr_2O_3. The authors hoped that a spectrophotometer would be capable of differentiating the contributions made to the overall color by the various coloring constituents, and permit the quantitative determination of FeO and, possibly, of other constituents in the slags. These hopes have been largely realized.

Research Planned

The plan of research was to examine acid slags of widely differing analyses in a spectrophotometer and to attempt to correlate the resulting absorption curves with the chemical compositions of the slags as determined by standard chemical methods.

Samples are examined in a spectrophotometer either by transmitting light through them or by reflecting light from them. The former method was not attempted because no rapid means of preparing slags for examination was known. There remained, then, the method of utilizing reflected light. The first real problem encountered was the development of a technique of preparing the specimens for examination which could yield reproducible results. Otherwise, comparisons between slags would have been meaningless.

After considerable developmental work, a successful method was obtained which was characterized by the following three essential features:

1. Use of finely ground particles of a selected size range.
2. Addition of a small amount of an immersion oil to the sample.
3. Covering the sample with a flat cover glass.

The probable reasons why these conditions were necessary to obtain reproducibility will be treated in the theoretical part of the paper.

Having developed a satisfactory method of preparing the samples for spectrophotometric examination, a number of slags of different chemical composition (Table 1) were examined and correlations of the spectro-

Table 1—Chemical Analysis and Visual Color of Samples Used in Spectrophotometric Tests.

Sample No.	Composition, per cent FeO	MnO	Cr	Fe_2O_3	SiO_2	Steel	Visual Color
1-1	34.00	17.35	0.68	3.73	41.7	0.35	Shiny black
1-2	22.50	21.85	....	1.88	51.2	0.19	Medium yellow green
1-3	15.10	22.10	....	1.90	56.8	0.21	Light yellow green
2-1	29.18	22.93	1.77	5.88	43.0	0.36	Dull "cokey" black
2-2	22.22	23.70	1.42	2.44	49.0	0.31	Dark blue green
2-3	15.33	24.05	0.84	2.01	55.8	0.23	Light blue green
2-4	12.99	23.05	0.66	2.29	56.2	0.22	Light blue-gray green
3-1	31.40	20.20	0.77	3.56	44.7	0.31	Very dark green, nearly black
3-2	20.87	22.02	....	2.22	51.6	0.25	Medium gray green
3-3	14.33	22.67	....	1.47	55.9	0.16	Light yellow green
4-1	29.10	18.25	3.12	3.78	43.7	0.24	Dull black, graphitic looking
4-2	24.95	19.35	2.50	2.34	51.0	0.22	Very dark glassy green
4-3	19.79	19.72	1.98	1.29	51.0	0.19	Medium blue green
4-4	13.05	20.27	1.66	1.56	53.4	....	Light blue green
5-1	34.10	22.90	0.70	6.76	41.3	0.29	Very dark brown green
5-2	22.05	27.89	....	1.61	51.0	0.25	Medium yellow green
5-4	10.72	30.66	....	1.51	53.7	....	Light gray green
6-4	11.85	23.21	....	1.43	57.8	....	Light yellow green

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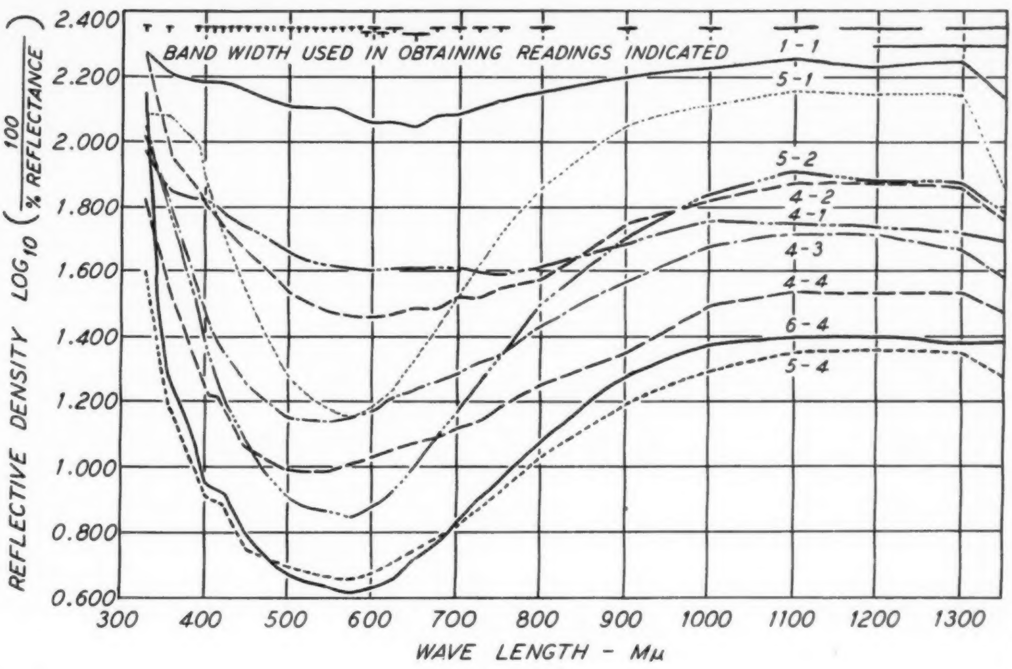


Fig. 1—Color density curves for acid slag samples.

photometric data with chemical composition were sought, with considerable success. These correlations make possible the rapid analysis of acid slags for FeO, MnO and Cr.

Experimental Section

Obtaining Slag Samples: The samples were taken from a two-ton acid electric furnace which was producing grade "B" and low-chromium steels for small castings. The plant employed the silicon reduction method. Slag samples ranging from highly oxidized black slags to highly reduced slags were obtained.

Samples taken during the heat were cast from a 4-in. spoon into a steel mold similar to a "pin test" mold except that it had a ¾-in. square hole. The funnel part of the sample was discarded because of excessive oxidation during cooling.

Ladle samples were obtained from the slag dumped from the ladle after the last metal had been poured. Air-oxidized portions of the slag were discarded. As this ladle slag was allowed to cool on the floor, the speed of cooling was considerably slower than that of the other slags which had been cast in steel molds. The spectrophotometric correlations which were found for these slags in spite of this difference in cooling rate is evidence that the cooling rate is not critical with this method, at least not on the high-silica slags.

Preparing Samples for Spectrophotometric Examination: The slag samples were finely ground in a diamond mortar and screened. The minus 100 plus 325 mesh material was chosen for the spectrophotometric examination, while the minus 325 mesh material was used for chemical analysis[5]. Preliminary experiments proved this procedure valid. Magnetic material was removed with an electromagnet. About ¼ teaspoon of ground slag was placed on a thin crown glass which had been coated with Shiliber's oil (heavy). The sample was then thoroughly mixed with the oil and gathered into a mound at the center. A second glass was placed on top of the first, squeezing the oiled sample into a round spot between the two glass surfaces.

Measuring Sample Density: A spectrophotometer equipped with an attachment for the examination of substances by reflected light measures the absorption of the sample compared to that of a standard at discrete wave-length bands in the range from 330 to 1380 mμ. When the reflective density

$$\log_{10} \frac{100}{\%\ \text{reflectance}}$$

is plotted as a function of the wave length, absorption curves characteristic of the substance examined are obtained[6]. The hills or peaks on these curves are caused by some constituent in the sample absorbing energy corresponding to those particular wave lengths. Thus, it is the height of these hills which might correlate with the concentration of the constituent causing the absorption [7,8,9].

All the slags were examined in a spectrophotometer with reflected light, using for the comparison standard a block of MgO which has greater than 96 per cent reflectance over the entire wave-length range studied. A plot of the data thus obtained is shown in Figs. 1 and 2. The predominant general characteristic of these curves is the strong absorption at short and long wave lengths

and the relatively weak absorption at the intermediate wave lengths[10,11].

Correlating FeO With Absorption Data: It was observed that only in the vicinity of 1100 mμ did the density of the slag samples increase in proportion to the FeO concentration. This is shown in Fig. 3 where the FeO content of the green slags is plotted versus the density at 1100 mμ. However, the black slags did not correlate well on this plot and have not been included. They will be considered in the section on MnO.

Thus, with the exception of the black slags, there is a fairly good straight-line correlation of per cent FeO in the slags and the density at 1100 mμ in the range studied. The average variation from the straight line is about 0.5 per cent FeO. For a rapid method, this is good accuracy. The potential speed of the determination will be considered later.

Correlating Cr_2O_3 With Absorption Data: Trial-and-error methods led to the conclusion that there is a correlation between the ratio of the densities at 650 mμ and 1100 mμ, and the Cr_2O_3 content of the slag reported here as chromium. This plot is shown in Fig. 4. The average variation from a straight line in this plot is about 0.04 per cent chromium. The black slags cannot be correlated in this manner and are not included.

Information in the literature[12] indicates that absorption peaks for oxides of chromium exist in the vicinity of 650 mμ.

MnO Correlated With Absorption Data: An examination of the absorption data disclosed that the densities of the slags were not in the same order as their MnO contents at any wave length. Therefore, more involved correlations were sought. It was observed that the absorption curves of slags with widely differing MnO contents, but similar FeO contents, diverged most at a wave length of 360 mμ; and that, conversely, the curves of slags of widely differing FeO contents, but similar MnO contents, diverged most at a wave length of 520 mμ. When the ratios of the densities at these two critical wave lengths were plotted as a function of the ratios of MnO to FeO in the slags, the data fell roughly on two straight-line segments which intersected at a 1:1 mol ratio.

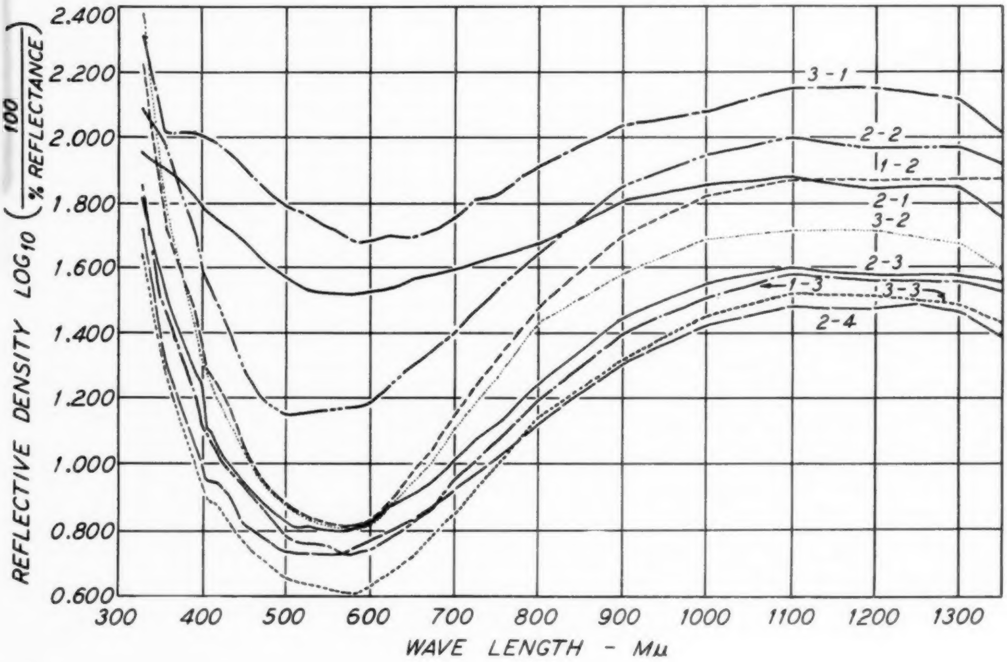
Departures from each of the straight lines were observed to be in proportion to the chromium contents of the slags. By trial-and-error procedures, a graph of the necessary correction for chromium was obtained. The correction graph and the final corrected graph of the MnO:FeO ratio as a function of the absorption ratio are given in Fig. 5. If the FeO content of a slag were known from the absorption at 1100 mμ, then this graph would permit the determination of the MnO content with an accuracy somewhat less than that of the FeO.

Black Slags and Absorption

It was further observed that the data for the black slags all fell on the low MnO segment of the graph. This was the first instance that a correlation of any kind had been found between the analysis of the black slags and the absorption data. Further examination of the absorption data of the black slags disclosed a correlation between the MnO content and the density at 400 mμ, as shown in Fig. 6.

In this case, also, a correction for chromium had to be determined and applied. In view of the more limited number of black slags, this graph is not as reliable

Fig. 2—Curves for color density of acid slag samples.



as the previous ones. However, it makes possible the determination of FeO in black slags in the following way: knowing the approximate chromium content from previous heats, and the absorption at 400 mμ, the MnO content can be determined. From this and the ratio of the densities at 360 and 520 mμ, the FeO content can be calculated.

Make Chromium Correction

The weakest point in this system of analysis of black slags is the necessity of making a correction for chromium. As no correlation of the absorption data with chromium has been found, the chromium has to be estimated from the results of the previous heats. An estimation error of one per cent chromium will result in an error of about 2.5 per cent MnO.

Spectrophotometric Analysis of Acid Slags for FeO, MnO and Cr: The manner in which this method of

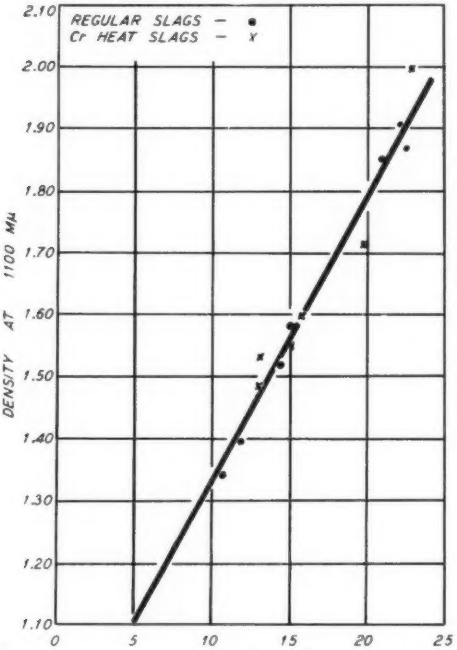


Fig. 3—Curve showing relationship of FeO in acid steel slags to the density at a wave length of 1100 mμ.

analyzing acid slags was developed has been described in some detail. The way in which the method would be used in practice is as follows: a slag sample would be taken and prepared for spectrophotometric examination by the technique already described. This would require only a few minutes. The sample would then be inserted in the comparison chamber of a spectrophotometer[6] and the reflective density would be measured at the four selected wave lengths.

From this data, by reference to the graphs, the FeO, MnO and Cr would be determined. The whole analysis

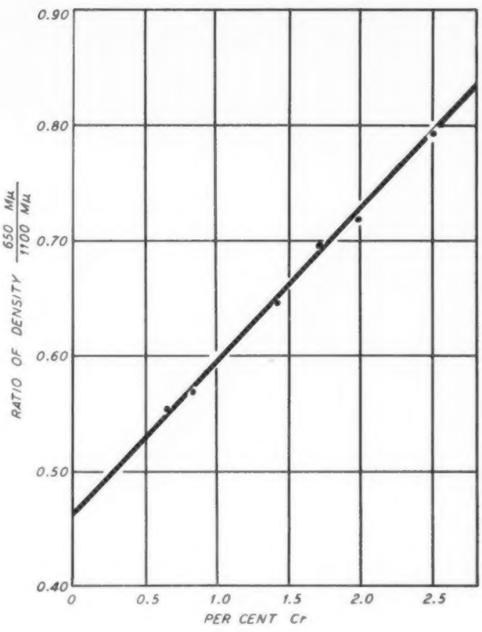


Fig. 4—Curve showing relationship of chromium in acid steel slags to the density ratio 650 mμ: 1100 mμ.

probably would not require more than 3 to 5 min. The outstanding feature of the method would be its extreme speed.

Spectrophotometric Analysis of Green Acid Slag: To demonstrate how easily a slag analysis can be calculated, an example will be considered in which the spectrophotometric data on a green slag is assumed to be as follows:

Wave Length	Reflective Density
360 mμ	1.770
520 mμ	0.875
650 mμ	1.000
1100 mμ	1.854

Referring to Fig. 3, the density of 1.854 at 1100 mμ is found to correspond to 21.0 per cent FeO.

Ratio of the density at 650 mμ to the density at 1100 mμ is 1.000:1.854, which is 0.539 and corresponds to 0.66 per cent Cr, according to Fig. 4.

Ratio of the density at 360 mμ to that at 520 mμ is 1.770:0.875 or 2.025. To this must be added the correction for chromium which, according to Fig. 5, is 0.231. The corrected ratio, 2.326, corresponds to an MnO:FeO ratio of 1.05 according to Fig. 5. The percentage of MnO then equals 1.05 times 21.0 or 22.2 per cent. Thus, the analysis of this slag is 21.0 per cent FeO, 22.2 per cent MnO, and 0.66 per cent Cr.

Using Correction Curve

Spectrophotometric Analysis of Black Slag: Calculation of the analysis of a black slag is somewhat different. It will be assumed that the chromium has been estimated as 0.50 per cent from previous heats and

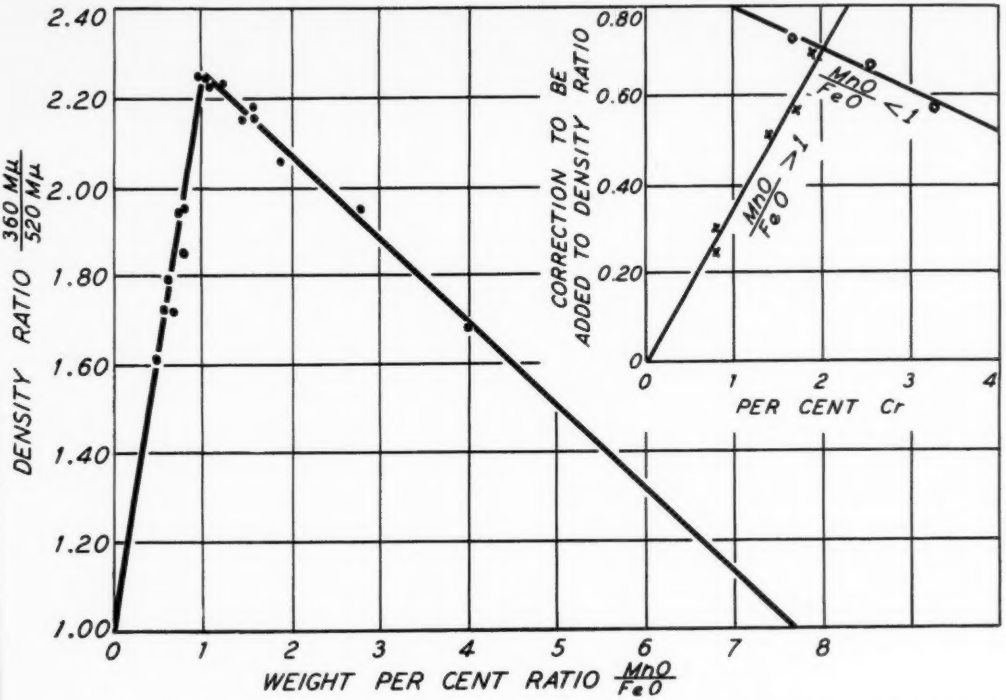


Fig. 5—Graph showing relationship of the weight per cent ratio MnO:FeO to density ratio 360 mμ: 520 mμ.

that the following spectrophotometric data have been determined:

Wave Length	Reflective Density
360 mμ	2.098
400 mμ	1.880
520 mμ	1.222

The correction for chromium, which must be added to the density reading at 400 mμ, is found to be 0.075 by referring to Fig. 6. The corrected density, 1.955, corresponds to 23.25 per cent MnO, according to Fig. 6.

Ratio of the density at 360 mμ to that at 520 mμ is 2.098:1.222 or 1.71. The correction for chromium, which must be added to this, is found to be 0.175 by referring to Fig. 5. The corrected ratio, 1.885, corresponds to an MnO:FeO ratio of 0.72. The percentage of FeO then is 23.25:0.72 or 32.3 per cent. Thus, the slag analysis is: 23.25 per cent MnO, 32.3 per cent FeO and 0.50 per cent Cr.

Theoretical Section

A complete theory which satisfactorily explains the practical results obtained in this investigation has not been developed. Fundamental studies will be necessary to establish such a theory. Nevertheless, a rough picture of the situation may be worth presenting at this time.

It is believed that the slag specimens investigated consisted of fine primary crystals embedded in a glassy matrix, similar in many respects to colored vitreous enamels and colored glazes. It is likely that the glassy matrix was primarily responsible for the selective absorption of light within the slag particles, but this, of course, would depend upon the nature of the primary crystals and the composition of the matrix. The primary function of the crystals, so far as the development of color is concerned, was to act as non-selective reflectors of light. Unless something was present to reflect light back to the surface, the glass would have had no color by reflected light.

Primary Crystallization

It can be presumed that the primary crystals in slags taken late in the heat were silica since the slag was well saturated with silica at this stage. Earlier in the heat, the slag composition might not have been in the primary field of crystallization of silica. It would be difficult to surmise as to which primary crystals were present in these early slags without further investigation. The ternary FeO-MnO-SiO_2 is not well established in the region involved, and the effects of small amounts of Fe_2O_3 and Cr_2O_3 on the primary crystallizing constituents are not known.

Magnetite, Fe_3O_4, and chromite, $FeCr_2O_4$, if they were present even in small amounts, presumably would be intense coloring agents. The break in the curve in Fig. 5 at the 1:1 mol ratio of FeO to MnO may be the result of changing from one primary field of crystallization to another at this composition.

Without knowing the size and number of the crystals and the relative absorbing powers of crystal and matrix, it is difficult to attempt to show why a straight-line

relationship was found to exist between the reflective density

$$\log_{10} \frac{100}{\%\ \text{reflectance}}$$

at certain wave lengths and the percentage composition of several constituents. However, in a qualitative way it is easy to see why the reflective density was greater the higher the concentration of the coloring agent in the matrix, in the case where the matrix contains the principal coloring agent.

Light of a wave length which is absorbed on entering the glass and traversing the matrix to the crystals will be absorbed according to Beers' law: $I = I_0 e^{-bcx}$ where

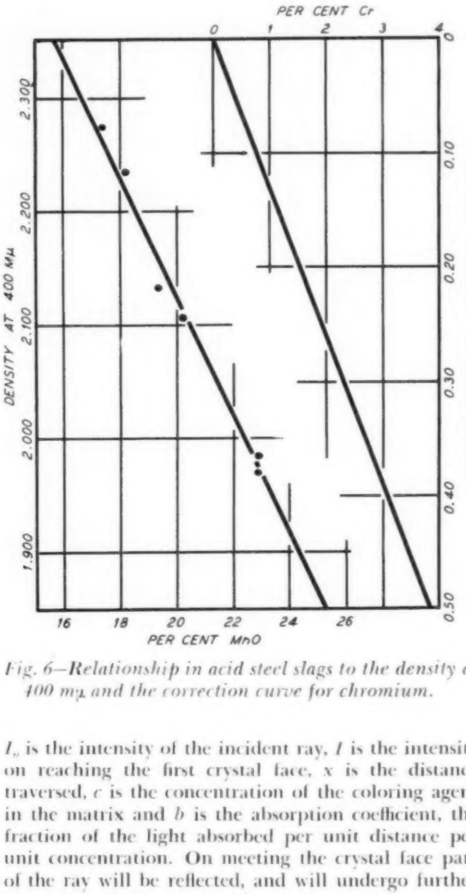


Fig. 6—Relationship in acid steel slags to the density at 400 mμ and the correction curve for chromium.

I_0 is the intensity of the incident ray, I is the intensity on reaching the first crystal face, x is the distance traversed, c is the concentration of the coloring agent in the matrix and b is the absorption coefficient, the fraction of the light absorbed per unit distance per unit concentration. On meeting the crystal face part of the ray will be reflected, and will undergo further absorption before leaving the specimen.

Most of the ray will enter the crystal, where it will be partially reflected, etc. This ray will eventually be reduced to zero by absorption and reflection. Part of each portion which was reflected at each crystal face, after further absorption and reflection, eventually re-emerges from the specimen as reflected light.

If the concentration of the coloring agent is higher, more light is absorbed per unit distance traversed and, consequently, less remains to be reflected. Therefore, the total reflection will be greater in this case, assuming that the number, size and distribution of crystals is about the same as before. The reflective density at lower concentrations of the absorbing constituent is less in consequence.

It is also fairly evident, on the basis of this picture, why the use of an immersion oil is so necessary. When a dry powder is used, in addition to the reflections at crystal faces already mentioned, there are also reflections whenever a beam of light travels from one particle to another. Furthermore, this reflection is frequently a total reflection because of the great difference in index of refraction of the glass matrix and air.

If the slag is finely divided, these total reflections will turn back the rays before they have traversed very far into the specimen. Consequently, the contrast between the absorbed and the unabsorbed rays will be largely eliminated. The powder will appear lighter in color than the bulk slag. However, when the particles are embedded in an oil of similar index of refraction, little light is totally reflected at the particle interfaces. The visual color of the specimen then matches the original bulk slag color.

It is not practical to eliminate the non-selective reflections from the top surface of the sample, but by the use of a cover glass it is possible to direct all this reflected light back vertically. The reflecting attachment on the spectrophotometer is so designed that light reflected vertically does not enter the photocell. The elimination of this directly reflected light increases the contrast between the absorbed and non-absorbed rays.

One odd feature about the absorption data for the black slags merits special comment. According to Fig. 6, it is apparent that both MnO and Cr decrease the absorption of these slags at 400 mμ. If we were dealing with true solutions, it would be inferred from this that both of these constituents were reacting with some strong coloring agent, probably an iron compound, to form less colored compounds.

In this particular case, in which the slags consist of crystals in a glassy matrix, there is an alternative explanation for this phenomenon. The variation might be caused by a variation of the crystallization of the primary phase influenced by the composition of the original slag melt. Further investigation will be required as to the real reason for this relationship.

Conclusion

Rapid quantitative analysis of acid slags is possible by reflective spectrophotometry. FeO, MnO and Cr can be determined with greater accuracy than by other rapid methods. The sample must be carefully prepared by a prescribed technique involving grinding, sizing, mixing with oil and covering with a cover glass. The method should be of use in the control of acid steelmaking processes.

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Install a Shockless Power Molding Machine at University of Washington

THE FIRST MOLDING MACHINE of its type to be installed for use in a university foundry course, a shockless, jarless, power rollover and draw machine, manufactured by a Philadelphia foundry equipment

W. A. Snyder, left, University of Washington foundry instructor, demonstrates the working of the University's new molding machine, pointing out the operation of its quick change-over table to his students.

house, was recently set up at the University of Washington, Seattle, for the purpose of study in modern foundry techniques.

The University's new machine, obtained through the efforts of Prof. G. S. Schaller of the department of mechanical engineering, is equipped with a quick change-over table that cuts from five to ten minutes from the time formerly required to clamp pattern boards or core boxes to the rollover plate. Since its installation, many West Coast foundrymen, including members of the Washington chapter of A.F.S., have availed themselves of the opportunity to inspect this latest development in molding machines.

A.F.S. Tennessee Chapter Sponsors General Foundry Practice Course

A COURSE FOR FOUNDRY SUPERVISORY EMPLOYEES of the Chattanooga area, sponsored jointly by the A.F.S. Tennessee Chapter, the University of Tennessee and Chattanooga's Kirkman Vocational School, began February 28. Foundries of the area have contributed their key men as instructors for the course, which consists of weekly two-hour class periods to continue for 15 or 16 weeks.

The initial course is being given to 25 local foundry supervisors, who have been chosen as instructors for subsequent courses.

Instructors for the initial course are foundry executives from the Wheland Co., Combustion Engineering Superheater Co., Crane Co., Columbian Iron Works, Ross Meehan Foundries and the U. S. Pipe & Foundry Co. All training activities are being co-ordinated by G. A. Hesse, U. S. Pipe & Foundry Co.; Wiley Thomas, Jr., University of Tennessee; and Raymond Sullinger, director of the University of Tennessee's Extension Branch. The initial course is being held at the plant of the U. S. Pipe & Foundry Co. Subjects, conference leaders and committe members for the course are as follows:

History and Foundry Background (2 hours). Conference leader, G. A. Hesse, U. S. Pipe & Foundry Co.

Metallurgy and Melting (4 hours). Conference leader, C. R. Genung, Ross Meehan Foundries. Committee members: C. S. Chisholm, The Wheland Co.; K. C. Riley and H. B. Young, U. S. Pipe & Foundry Co.

Laboratory Control and Physical Testing (2 hours). Conference Leader, Harry Nelson, Crane Co. Committee members: L. Leventhal, The Wheland Co.; J. D. Cliott, Jr., Crane Co.; and J. Kosik, Combustion Engineering Superheater Co.

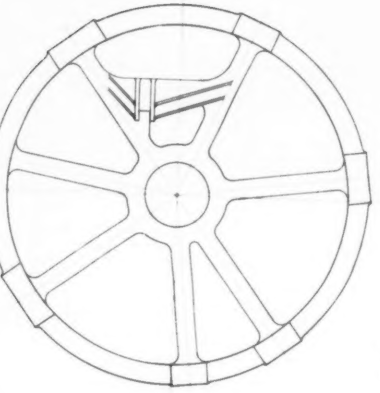
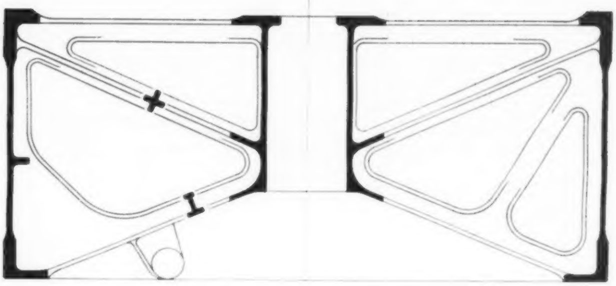
Molding and Coremaking (8 hours). Conference leaders, W. B. Erb and W. Lawrence, U. S. Pipe & Foundry Co. Committee members: H. LuKrafka, The Wheland Co.; L. J. Mars, Crane Co.; D. Andrews, Columbian Iron Works; A. L. Imms, Combustion Engineering Superheater Co.; W. W. Westler, Ross Meehan Foundries; and E. Griedler, Combustion Engineering Superheater Co.

Sand and Sand Control (4 hours). Conference leader, T. C. Alford, The Wheland Co. Committee members: B. Howard, U. S. Pipe & Foundry Co.; R. B. Young, Combustion Engineering Superheater Co.; C. R. Genung, Ross Meehan Foundries; C. E. Jones, Columbian Iron Works.

Inspection and Casting Defects (4 hours). Conference leader, Carl Barker, Crane Co. Committee members: W. L. Austin, U. S. Pipe & Foundry Co.; C. S. Turner, Combustion Engineering Superheater Co.; Roy Jackson, Ross Meehan Foundries.

Equipment (6 hours). Conference leaders: K. L. Landgrebe, The Wheland Co.; John Lassiter, Combustion Engineering Superheater Co. Committee members: J. A. Goodlett, U. S. Pipe & Foundry Co.; M. Marks, Crane Co.; T. A. Deakins, Combustion Engineering Superheater Co.; W. B. Greiser, Ross Meehan Foundries.

Certificates will be issued by the University upon satisfactory completion of the course.

Figs. 1 and 2—Top view (left) and sectional view (above) of aluminum alloy wheel casting—72-in. diameter; 33-in. height, 1,000-lb finished weight.

CAST LARGE ALUMINUM WHEEL

Dry Sand Cores Used as Pattern Equipment

Louis Schmidt
Pattern Shop Foreman
Aluminum Co. of America
Cleveland

An unusual type of pattern equipment or molding method has been used in the Cleveland sand foundry of the Aluminum Co. of America to cast a large aluminum alloy (7 Si; 0.3 Mg; balance Al) wheel 72 in. in diameter, with a maximum height of 33 in. and a finished weight of about 1,000 lb. The wheel casting offered a challenge to the molding art because no two sections between the spokes were of equal dimentions and the average wall thickness was only 7/16 in.

While the molding method used is not new, some of the refinements developed are of interest. The casting was of unusual size for aluminum foundries, although larger castings with thicker sections have been made. It is recognized that a casting of this type with spoke sections of ¾-in. thickness probably would occasion no difficult problems in an iron or steel foundry.

The general shape of the casting is shown in Fig. 1, which is a top view showing the circular flange and the ribbed or flanged spokes extending from the center hub. Fig. 2 is cross section through the center of the wheel and reveals the interior structure. It is apparent from the two illustrations that several molding methods could be used to cast the wheel, although only one will be described. This method was considered to be the most economical one that would produce a sound, accurate casting.

It was decided not to construct a pattern but to produce the casting by means of dry sand cores. Molding the large pattern with the attached core prints that would be required for this wheel would substantially increase the cost of production. Also, it is difficult to set heavy, large cores in a green sand mold without crushing the mold in certain areas.

In producing the dry sand equipment the first step was to select a procedure that would insure accurate assembly of the cores. It was decided to assemble the cores on a flat plate which would serve as a base for the mold. A spindle guide, inserted in the center of the flat plate, was sufficiently long to extend to the top of the cored portion of the mold.

Next, consideration of various mold parting arrangements indicated advantages in making base cores that would extend from the inside of the bottom flange surface to the exterior of the core assembly. These base cores had to be thick and strong enough to support the side cores and to sustain part of the weight of the cover cores.

Seven core boxes for the base core sections were to correspond to the seven unequal divisions defined by the spoke locations. The smaller sectional core boxes simplified the coremaking and the joints between the base core sections functioned as a gage for setting the side cores. These base cores were set on the base plate by means of a gage attached to the center guide spindle and extending to the inside diameter of the bottom of the flange. After proper location, the base cores were securely fastened to the flat base plate.

Probably the most important step in the procedure was the construction and assembly of the large body (spoke) cores. The body cores extended from the top to the bottom of the casting and from the center to the inner surface of the outer wall. The core boxes required for the body cores were of varying sizes and contained most of the complex ribs, flanges, webs, and bosses, which are the critical structure of the casting. Twenty core boxes were required for the body cares.

Fig. 3 in a perspective view of one of the body cores. It can be seen that the core box was split in the center of each section, necessitating a right and left core box. The top and bottom faces of the cores were made as loose pieces in the core box to insure flat faces without draft. The top and bottom surfaces were important because cover cores set on top of the body cores in the assembly of the mold and the cores are directly in contact with the base plate.

Weights of the dry sand body cores ranged from 200 to 500 lb. A gage was attached to the center spindle which extended from the center to the outside surface

Note: This paper was presented before the A.F.S. Northeastern Ohio Chapter, at Cleveland, Nov. 11, 1948.

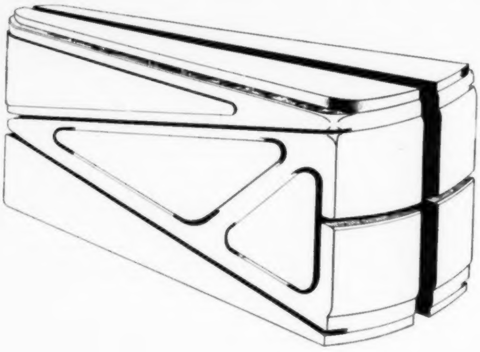
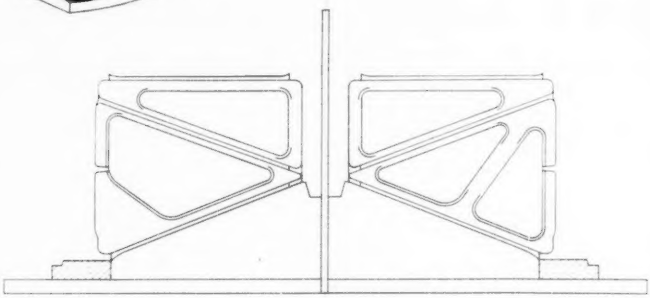


Fig. 3—Perspective view of one of the body cores for the aluminum wheel casting. Note that the core box was split in the center of each section, requiring a right and left core box.

Fig. 4—Base and body cores assembled on base plate with gaging spindle in the center.



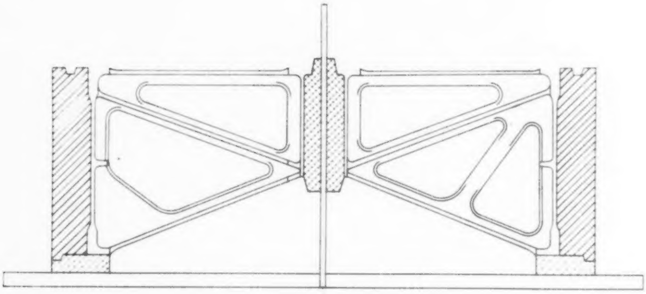
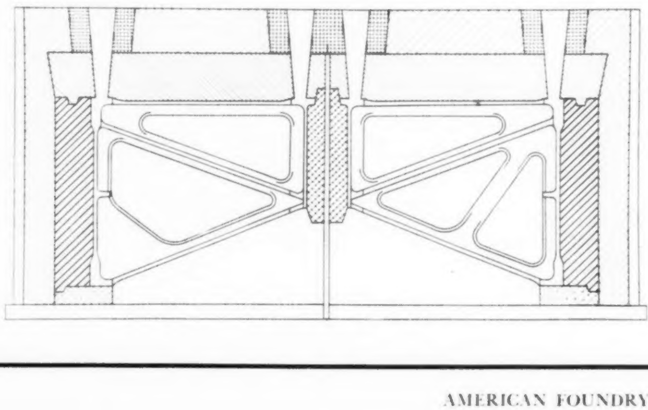


Fig. 5—Hub and side cores have been added to the assembly shown in Fig. 4.

Fig. 6—Sectional view of the completed mold showing riser cores, flask and molding sand in place.



of the body cores to check for tilting and eccentricity. The use of a gage was absolutely necessary in setting these cores, as well as most of the others, because the exact shapes or dimensions of such large cores cannot be maintained during handling and baking. As would be expected, some fitting was required in setting the body cores. The base and body cores in position on the base plate are shown in Fig. 4.

Arrangement of the side cores which form the exterior surface of the side wall was the next step in assembly (Fig. 5). These cores were also made in seven sections because of the pads and bosses, and to facilitate accurate setting on the base cores. Similar to the body cores, the core boxes for the side cores were made with loose pieces on top and bottom surfaces in order to procure flat faces. The side cores were set by means of locators in the base cores and gages of the same thickness as the side wall of the casting.

Core Setting Method

The hub or center core was made in two halves pasted together. The guide spindle served as a locator for setting this core on the body cores. The core box for the hub core was a simple, half-round dump box with a half-round loose piece at the parting.

The final step in the operation consisted of setting the cover cores which formed the upper surface of the casting. These cover cores, shown in Fig. 6, rest on the side, body, and hub cores previously described. Again seven separate sectional core boxes were made for the cover cores. The core boxes consisted of large flat dump boxes with the necessary flanges, ribs and pads that produced the top surface of the casting. The cover cores were located in the proper position in the assembly by means of the center guide spindle, locators, and the joints of the side cores.

It is now apparent that the entire casting was formed by dry sand cores and that no pattern was used in the construction of the mold. No serious problems were encountered in the making and assembly of the dry sand cores.

A shrinkage allowance of $\frac{1}{12}$-in. per ft was used in making the core boxes because it was realized that the hard cores would prevent the aluminum alloy from contracting the normal amount. Dimensional inspection of the castings demonstrated the suitability of this shrinkage allowance. The core boxes were made of a good grade of pine which provided equipment satisfactory for production of the 20 castings that were required. About 6,000 ft of lumber was used for the 42 core boxes and the necessary gages. It was necessary to raggle in the corners of the core boxes and reinforce with glued corner pieces. Screws were used throughout the core box construction to insure rigidity.

Assembling the Mold

Completion of the molding procedure and foundry operations will be described briefly. The central guide spindle was removed before any sand was placed on the top of the mold. The outermost walls shown in Fig. 6 represent the flask which was placed around the assembled cores on the base plate. Next, the riser cores were placed on top of the cover cores at stragetic positions for feeding the casting. Fig. 6 also shows the location of the riser cores. Molding sand was rammed lightly in between the flask and the cores to the height of the cores. Then a continuous runner which surrounded the cores was formed by cores placed on top of the molding sand.

Branches from this runner core were placed so as to lead into seven ladder gates incorporated in the side cores at the approximate center of each. Two sprues, shaped by cores, were located on opposite sides of the mold and were designed to permit a large flow of metal and yet restrict dross and inclusions from entering the casting. After setting the runner, risers and sprues, the mold was completely covered with molding sand. Two pieces of channel iron were placed across the mold and fastened by means of clamps to the base plate to obtain rigidity.

A few statistics regarding the flask, core and mold size are of interest. The flask was about 8 x 8 ft and 4 ft high. The approximate weight of the dry sand cores was 12,000 lb. The complete mold weighed about 13 tons and was assembled on the foundry floor.

About 2,000 lb of the aluminum alloy were melted and poured, which represent the total weight of the casting, sprues and risers. The actual casting weight was about 1,000 lb. Only 3 min were required for pouring. About 12 hr were allowed for the cooling of the casting, and about the same period of time was required to remove the casting from the mold. The long knockout time was required because of the hardness of the dry sand cores which served as the mold for the wheel casting. A hard core, of course, gives greater accuracy but presents difficulties in knockout. Some 20 satisfactory wheel castings were produced by the method described.

Future Meetings and Exhibits

American Institute of Mining and Metallurgical Engineers, National Open Hearth Steel Committee, annual meeting, Palmer House, Chicago—April 18-20.

Magnesium Association, Chicago—April 19-20.

Malleable Founders' Society, western sectional meeting, Palmer House, Chicago—April 22.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5.

Instrument Society of America, annual spring meeting, Royal York Hotel, Toronto, May 12-13.

Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Detroit—May 19-21.

Malleable Founders' Society, western sectional meeting, Palmer House, Chicago—May 27.

Steel Founders' Society of America, industrial relations meeting, Drake Hotel, Chicago—June 9-10.

Malleable Founders' Society, annual meeting, Homestead Hotel, Hot Springs, Va.—June 16-17.

American Society for Testing Materials, annual meeting, Atlantic City, N. J.—June 27-July 1.

Foundry Equipment Manufacturers Association, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 13-15.

Michigan Regional Foundry Conference, A.F.S. Michigan Chapters, Michigan State College, East Lansing—Nov. 15-16.

New York State Regional Foundry Conference, A.F.S. Upstate New York Chapters, Syracuse University, Syracuse, N. Y.—Nov. 25-26.

REPORT FOUNDRY ADVANCES

At Second Ohio Regional Conference

L. C. Brinser, E. H. Losely, D. M. Marsh, J. X. Matyskella and N. L. Sylvester
Members, Ohio State Student Chapter

New developments for the operating foundryman was the theme of the 2nd Ohio Regional Foundry Conference held March 11 and 12 in Columbus. Sponsored by the five Ohio A.F.S. chapters—Central Ohio, Northeastern Ohio, Canton District, Cincinnati, and Toledo—Ohio State University and the OSU Student Chapter of A.F.S., the Conference took place on the campus and at the Deshler-Wallick Hotel. University participation was evidence of strong interest in the foundry industry and was one of the school's special activities marking its 75th anniversary.

The Conference opened the morning of March 11 with registration in University Hall where the opening session was held. Chairman Fred W. Fuller, National Engineering Co., Columbus, welcomed attendants on behalf of the Central Ohio Chapter and cited the work of all chapters in planning and executing the Conference. He was followed by Prof. D. C. Williams, Ohio State University, who emphasized much of the behind the scenes efforts were made by student chapter members and urged foundrymen to give the students an opportunity to get acquainted. Dean C. E. MacQuigg of the OSU college of engineering, introduced by Dr. Williams, said that the school's responsibilities—instruction and research—were being devoted more and more to the foundry industry as a result of increased awareness of the industry's importance to society.

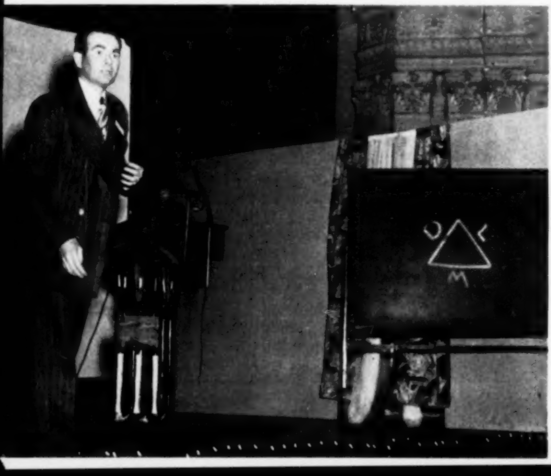
Opening technical session chairman was Dr. Jesse Huckert of the university who presided while two papers on design of castings were presented. First speaker was T. C. Kuivinen, Cooper-Bessemer Corp., Mt. Vernon, Ohio; his paper was *"The Design of Crankshafts and Center Frames for Diesel Engines."* W. T. Bean, Jr., consultant, Detroit, followed with a talk entitled *"Sound Castings CAN Be Engineered."*

Mr. Kuivinen discussed the use of newer design tools and showed how they can be used to take maximum advantage of the inherent properties of cast parts. He told how a brittle lacquer which ruptures when a piece deforms can be used for determining location and direction of stresses. This can be followed by electrical resistance strain gages to determine accurately the strain.

In his talk, to be published soon in AMERICAN FOUNDRYMAN, Mr. Kuivenen brought out how the new design tools and simulated service tests were used to improve cast diesel engine parts and to redesign a welded engine frame so it weighed less and cost less as a casting.

"You don't make a machine out of test bars, you make it out of castings," said Mr. Bean, in following the first speaker with additional information on modern casting design. In constructing anything it is necessary to evaluate the material, the design and the loads, he said, and gave a graphic demonstration of hidden design factors in a structure made of a coat hanger, a piece of wood, screw-eyes, thread and hammers.

W. T. Bean, Jr., consultant, Detroit, illustrating evaluation of material, design and load on a cast structure.



University President Addresses Luncheon

Dr. Howard A. Bevis, president of Ohio State University, spoke at lunch and added a third function of the university—service—to the two mentioned earlier by Dean MacQuigg. He said use of school facilities by the Ohio Regional Conference was an example of such service. Presiding at the meeting was Dr. Williams who asked H. J. Gonya, chairman of the OSU Student Chapter to stand for recognition, and introduced Dr. Paul N. Lehoczky, chairman of the department of industrial engineering.

Dr. Lehoczky outlined the curriculum followed by students especially interested in foundry work and explained that such curricula are shaped on the basis of pressures created by various groups interested in the students. The foundry industry, he said, expressed a wish for development of foundry courses and has been cooperative in setting them up but has allowed the school a free hand in developing the curriculum.

Two sets of sectional meetings for gray iron, steel, malleable iron and non-ferrous foundrymen were held in the afternoon. *"Something New in Foundry Sand,"* was the topic at the first gray iron session. Harry W. Dietert, Harry W. Dietert Co., Detroit was the speaker; E. H. King, Hill & Griffith Co., Cincinnati, and K. F. Schmidt, United Engineering & Foundry Co., Canton, presided.

Mr. Dietert discussed the effect of ferrostatic pressure on mold volume and pointed out that sand with high green deformation will deform easily and rapidly under this pressure. Increase in mold volume after the

in-gate or riser has frozen will produce unsound castings, he said. He described a new sand, appropriately called carbon sand, composed essentially of crushed coke and graphite. Carbon sand has low deformation, low expansion and is non-siliceous. Mr. Dietert explained that this new molding material is still in the experimental stage.

Second gray iron speaker was Lyle L. Clark, Buick Motor Car Co., Flint, Mich. Chairman and co-chairman were Herman K. Ewig, Cincinnati Milling Machine Co., Cincinnati, and Lloyd W. Leeseberg, Superior Foundry, Inc., Cleveland. Speaking on *"Recent Developments in Cupola Operation,"* Mr. Clark pointed out that fundamentals of cupola melting practices remain the same and urged foundrymen not to depart too far from them.

Mr. Clark said one of the best ways of reducing cupola operating costs is to reduce the amount of coke needed to melt a given weight of metal. Suggested ways to do this include: charging clean scrap and sprue, maintenance of correct bed height, avoiding

C. O. Burgess, Gray Iron Founders' Society, Cleveland, reviewed status of nodular graphite iron. (Conference photos by W. H. White, Jackson Iron & Steel Co.)

excess air, sizing scrap, and charging metal around the wall of the cupola with the coke in the center. He described an improved chill test more sensitive to changes in analysis and less sensitive to temperature variation (see AMERICAN FOUNDRYMAN, February, 1949, page 39).

First day's steel meetings included papers by Robert G. Scott, Commercial Steel Castings Co., Marion, who spoke on *"Good Housekeeping Pays Off,"* and by A. J. Kiesler, General Electric Co., Schenectady, N. Y. whose topic was *"Metal Penetration."* Presiding at the first session was Robert Jansen, Unitcast Corp., Toledo; R. E. Fisher, Jr., Bonney Floyd Co., Columbus, was chairman of the second meeting.

As in any industrial plant, keeping a foundry clean is a never-ending job but the task is not hopeless, said Mr. Scott. Good housekeeping results in longer life for equipment, less handling of equipment and materials

Early Conference registrants filled the corridors of University Hall, on the Ohio State University campus.

and reduction of accidents, he said. These are achieved, according to Mr. Scott, by providing sufficient storage and aisle space, preventive maintenance, materials handling facilities, painting and adequate light, good ventilation and dust collection.

Penetration can be eliminated through proper grain size and distribution, according to Mr. Kiesler. He described experiments conducted on cores placed in a special mold with a swirl gate for maximum erosive action, and a 36 in. ferrostatic head. In outlining the work, he told how a suitable mixture of coarse and fine grains eliminated penetration and veining.

Describes Production Patternmaking

First malleable iron session speaker was V. J. Sedlon, Master Pattern Co., Cleveland. Speaking on *"Production Patterns for Malleable Foundries,"* he pointed out the various patternmaking considerations—core print clearance, crushing strips, keying cores, finish allowance and others—important in production patterns. Included in Mr. Sedlon's paper was discussion of patterns made of aluminum, iron, plastic materials and electroformed copper. The paper will appear in AMERICAN FOUNDRYMAN in May. John W. Clarke, General Electric Co., Erie, Pa., presided at the session.

"Metallurgical Headaches of Scrap Iron in the Malleable Industry," was the subject of Milton Tilley, National Malleable & Steel Castings Co., Cleveland. Foundrymen can expect continuation of trouble with scrap, particularly with high alloys, said the speaker, in outlining typical troubles. Mentioned were problems created by chromium, molybdenum, solder and miscellaneous tramp elements.

Glen W. Mehltretter, International Nickel Co., Bayonne, N. J., talked on *"Investment Casting As We Know It Today,"* at the first non-ferrous meeting. John G. Kura, Battelle Memorial Institute, Columbus, presided and Harvey Flynn of International Nickel, answered questions during the discussion period. Describing the lost-wax process of precision casting as generally practiced today, Mr. Mehltretter pointed out that the process is expensive but very useful. Parts difficult or impossible to machine can be made by the process on a production basis to tolerances of about 0.001 in. Time to get a new part into production is one to six weeks depending on the complexity of the part

and the time required to produce the die for making the wax patterns.

Men, materials and machines must be considered by the foundryman, said William M. Ball, Jr., R. Lavin & Sons, Inc., Chicago, in discussing *"Another Approach to New Developments in Making Non-Ferrous Castings."* Harry G. Schwab, Bunting Brass & Bronze Co., Toledo, was meeting chairman. The speaker discussed the integration of the three M's for most economical production of castings, pointing out the need for careful consideration of each casting job, the way it is to be handled, the materials to be used in its production, and the men who are to produce it.

A.F.S. National Officers Attend

Following completion of the technical sessions at Ohio State University, the Conference moved to the Deshler-Wallick Hotel for dinner and the next day's meetings. Presiding at the dinner was National Director N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio. He called on A.F.S. President W. B. Wallis who discussed regional foundry conferences, pointing out that their strength lies in continuity. Emphasizing the value of conferences held in conjunction with educational institutions, he said that two new conferences were planned for the fall, one to be held at Syracuse University, the other in the Pacific Northwest. President Wallis suggested increased coordination of regional foundry conferences with student chapter activities and commended the OSU Student Chapter for its part in making the 2nd Ohio Regional Foundry Conference a success.

Dinner speaker was Dr. Eleroy L. Stromberg, Western Reserve University, Cleveland. His talk, *"We CAN Select the Bonus Worker,"* soon to appear in AMERICAN FOUNDRYMAN, outlined simple, quick procedures suitable for selection of workers who will do more satisfactory work and fit into an organization better. First psychologist to conduct his work in the foundry field, Dr. Stromberg pointed out that he has more than a casual interest in the industry because he is the grandson of a Swedish molder. Well over 100 members of the audience crowded up to the speaker at the conclusion of his talk to ask questions.

The second day of the Conference continued the sectional meetings and concluded with a luncheon. Heavy attendance marked the early morning gray iron meeting, foundrymen coming to hear C. O. Burgess, Gray Iron Founders' Society, Cleveland, talk on *"Methods of Production and Properties of Nodular Gray Iron."* Co-chairmen of the meeting were A. W. Schneble, Advance Foundry Co., Dayton, and C. H. Lorig, Battelle Memorial Institute.

Some of the members of the A.F.S. Student Chapter at Ohio State who helped make the Conference a success.

Mr. Burgess reviewed the present status of nodular or spheroidal cast iron, starting with the disclosure of the process in 1948 by workers of the British Cast Iron Research Association. Early work with cerium and later developments coming out of this country in the use of magnesium were outlined. No completely satisfactory explanation for the mechanism of nodular graphite formation has been proposed.

In a thorough review of published literature on the subject, the speaker gave the advantages and disadvantages of the processes now used for producing nodular graphite iron and pointed out that much needs to be learned before anyone can predict the place of the new material in the engineering field. He urged as many people as possible to work in the field and report their progress and cited the consumer pressure likely to build up and the probable strategic importance of the material in time of war.

Final gray iron speaker was E. E. Ballard, Lester B. Knight & Associates, Chicago. He spoke on *"The Modern Gray Iron Foundry"* at a session headed by J. D. Judge, Hamilton Foundry & Machine Co., Hamilton, and R. C. Van Hellen, Unitcast Corp., Toledo. Mr. Ballard outlined progress in modernizing and mechanizing gray iron foundries and described typical installations of mechanical foundry facilities.

Outlines Use Of Oxygen in Melting

Steel foundrymen heard George E. Bellew, Air Reduction Co., Detroit, outline use of oxygen in melting in his talk, *"Oxygen Injection Treatment of Steel Melts."* Meeting chairman was W. H. Heimberger, Buckeye Steel Castings Co., Columbus. Apparatus needed for use of gaseous oxygen instead of iron ore is simple, said Mr. Bellew, in introducing his paper scheduled for AMERICAN FOUNDRYMAN later this year. Acid electric furnace operators have been able to show substantial savings in melting costs, he said, by utilizing the increased rate of carbon elimination and increase in bath temperature. In open hearth work, oxygen gives furnace operators greater flexibility in timing heats. He outlined methods of using oxygen in acid and basic furnaces and in melting and refining stainless steels.

Last steel session speaker was R. M. Landis, General Electric X-Ray Corp., Cleveland, who discussed *"X-Ray and Its Practical Application for the Steel Foundryman."* Clarence E. Sims, Battelle Memorial Institute, presided. Mr. Landis outlined practical problems and value of radiographic examination of steel castings.

Malleable speakers the second day were Harold G. Sieggreen, General Motors Corp., Saginaw, Mich., and John A. Zeindler, Albion Malleable Iron Co., Albion, Mich. Mr. Sieggreen spoke on *"Gating and Risering of Malleable Castings,"* with S. E. Kelly, Eberhard Manufacturing Co., Cleveland, presiding. *"Finishing Control,"* was Mr. Zeindler's topic; chairman of the session was John M. Urban, Fanner Manufacturing Co., Cleveland.

The Central Foundry Division has established en-

Interested after-dinner crowd discussing pre-selection testing of foundry employees with Dr. Elevoy L. Stromberg of Western Reserve University, Cleveland.

gineering departments in all plants of General Motors Corp. to coordinate experience of the various department heads into the design of pattern equipment, Mr. Sieggreen said. All patterns, core boxes, driers, etc., are drawn up in full detail, he explained, leaving nothing to the patternmaker's judgment. This simplifies maintenance and replacement and aids in obtaining quotations on patterns, he said. The bulk of Mr. Sieggreen's talk, scheduled to be published in AMERICAN FOUNDRYMAN, dealt with illustrations and explanations of various successful gating and risering systems.

Mr. Zeindler described experiences in his company's foundry which led to more efficient use of existing facilities to give better production in the cleaning and finishing department. He outlined the studies which caused the plant to employ better maintenance to keep equipment operating and to provide adequate storage space to minimize rehandling of castings.

"*New Developments in Determining the Fluidity of Aluminum Alloys,*" was the topic of Walter E. Sicha, Aluminum Company of America, Cleveland, at a nonferrous session presided over by L. W. Eastwood, Battelle Memorial Institute, Columbus, and Walter J. Klayer, Aluminum Industries, Inc., Cincinnati. Mr. Sicha described a modified flat spiral type of fluidity test and outlined the precautions needed for its successful use. Actual experience with the test shows, he said, that the careful control required is not as formidable as it appears.

Hold Non-Ferrous Melting Round Table

Final non-ferrous session was a round table discussion of melting methods and equipment with R. W. Parsons, Ohio Brass Co., Mansfield, as chairman. Speakers were: Fred G. Glass, The Deming Co., Salem; Jack Ziessman, Grabler Manufacturing Co., Cleveland; W. R. Huffman, H. B. Salter Manufacturing Co., Marysville; and W. J. Doelker, National Cash Register Co.

At the luncheon which concluded the Conference, D. A. Krause, Gray Iron Research Institute, Inc., Columbus, presided. The program was provided by the Foundry Educational Foundation, Cleveland, with George K. Dreher of the Foundation acting as discussion leader for a panel on "*The Employer Looks at the Engineering Graduate.*" Panel members were: Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, A.F.S. Vice-Presidential nominee; Herman K. Ewig, Cincinnati Milling Machine Co., Cincinnati; National Director W. J. MacNeill, Dayton Malleable Iron Co., Dayton; John M. Price, Ferro Machine & Foundry Co., Cleveland; and National Director V. E. Zang, Unicast Corp., Toledo. These men, all representing top management, reported briefly on their successful experiences in training and using engineering college graduates in supervisory positions.

General chairman for the Conference, Dr. Douglas C. Williams, Ohio State University, was assisted by the following committee chairmen and members:

Program—Chairman, D. E. Krause, Gray Iron Research Institute; vice-chairman, N. J. Dunbeck, Eastern Clay Products Co.; Fred J. Pharr, Lake City Malleable Iron Co.; J. S. Schumacher, Hill & Griffith Co.; Harry J. Schwab, Bunting Brass & Bronze Co.; Charles F. Bunting, Pitcairn Corp.; George K. Dreher, Foundry Educational Foundation.

Registration—Chairman, Kenneth McGrath, Altens Foundry & Machine Co. Assisted by members of the Ohio State University student chapter.

Publicity—Chairman, J. G. Lummis, A. P. Green Firebrick Co.; C. P. Greenidge, Battelle Memorial Institute; Karol Whitlach, Aetna Firebrick Co.; Wilfred H. White, Jackson Iron & Steel Co.

Housing—Chairman, Walter Deutsch, Columbus Malleable Iron Co.; E. M. Durstine, Keener Sand & Clay Co.

Finances—Chairman, William T. Bland, Commercial Steel Castings Co.; J. J. Witenhafer, Columbus Malleable Iron Co.; Robert Willey, Commercial Steel Castings Co.

Student Participation—Ohio State University student chapter of American Foundrymen's Society.

Describe Ammonia-Hydrochloric Acid Test For Pressure Equipment Leaks

A 23-YEAR OLD METHOD of testing for leaks in pressure equipment came to light at the recent All-Canadian Foundry Conference, when A.F.S. Past National Director and Gold Medalist Harold J. Roast, Montreal consulting metallurgist, recalled details of an ammonia-hydrochloric acid pressure test.

The method was outlined in the "Kinks and Short Cuts" department of *Chemical and Metallurgical Engineering* for August, 1925. Described by W. S. Talcott of Jackson Laboratory, Chemical Engineering Division, E. I. Du Pont de Nemours Co., Wilmington, Del., the method is, in substance as follows:

Fill the vessel with anhydrous ammonia gas under pressure (preferably at least equal to the working pressure to which the apparatus is subjected), then test for the ammonia gas by means of hydrochloric acid vapor. Because of the low viscosity of a gas as compared with a liquid, compressed gas will leak through a minute flaw.

Test is made by blowing air through hydrochloric acid contained in a wash bottle—directing the stream of air containing acid against the surface of the vessel. Even a slight leak is revealed by the resultant white cloud of ammonium chloride. In at least one instance, apparatus which would hold 500 lb water pressure without perceptible leak was so porous on the ammonia test that pressure could not be raised above 25 lb.

FOUNDRY *Personalities*

The appointment of three men to sales managerial positions at the Sterling Grinding Wheel Division of the Cleveland Quarries Co., Tiffin, Ohio, is announced. **Ralph H. Lott,** Chicago district sales manager, will become coordinator of sales. **Arthur J. Schneider,** formerly assistant sales manager, will become sales manager. **William F. Schick** replaces Mr. Lott as Chicago district sales manager.

William E. Carver, formerly chief engineer of Permacel Aluminum & Brass Corp., Waltham, Mass., has been appointed chief engineer of Light Metals, Inc., Indianapolis, Ind. Mr. Carver also served in executive engineering capacities with Bohn Aluminum & Brass Corp., Detroit; Monarch Aluminum Mfg. Co., Cleveland; and with the Foundry Division of Reynolds Metals Co., Springfield, Mass.

R. S. Bradley, director of research for the A. P. Green Fire Brick Co., Mexico, Mo., has been promoted to head the company's newly-created Research and Engineering Division. The new division is composed of three sections—Research Engineering, headed by **A. R. Lesar;** Industrial Engineering, by **W. D. Clark;** and Plant Engineering, by **J. C. Potts.** Mr. Bradley is a member of the Technical Advisory Committee of the American Refractories Institute and vice-chairman of the CA Committee of the ASTM.

Prof. R. W. Drier of Michigan College of Mining and Metallurgy has been made Professor of Theoretical and Applied X-Rays at that institution.

C. R. Tipton, Jr.

Clyde R. Tipton, Jr., research engineer with Battelle Memorial Institute, Columbus, Ohio, has accepted a position as metallurgist at the Los Alamos, N. M., laboratory of the University of California. Mr. Tipton holds B.S. and M.S. degrees from the University of Kentucky.

Luther A. Kleber, since 1947 assistant works manager of the Commonwealth plant of General Steel Castings Corp., Granite City, Ill., has been appointed assistant vice president in charge of manufacturing, with jurisdiction over the company's Eddystone, Pa., and Granite City plants. He will continue to make his headquarters in Granite City.

Two new promotions in the Foundry Division of the Falk Corp., Milwaukee, are: **Fred A. Pritzlaff,** foundry superintendent for 15 years, to become a consultant on foundry problems to the vice-president and works manager. In addition to his consulting duties, Mr. Pritzlaff will continue to assume responsibility for pattern shop operations. **Carl Haertel** will become foundry superintendent in full charge of that department. He has been assistant superintendent of the foundry department since 1938.

Robert L. Collins, foreman and industrial engineer for the Aluminum Company of America since 1945, recently joined the Ford Motor Co., Dearborn, Mich., as industrial engineer. Holder of a B.S. in Metallurgical Engineering from the University of Michigan in 1942, Mr. Collins spent three years in the Army prior to joining International Nickel.

Richard S. Moore has been appointed manager of Basic Sales for the Harbison-Walker Refractories Co., Pittsburgh. He has been a member of that department since 1940, and with the company since 1929. He holds a degree in Ceramic Engineering from the University of Illinois, and has been responsible for many Harbison-Walker refractory developments.

Dr. John F. Thompson, since 1936 executive vice-president of the International Nickel Co. of Canada, Ltd., was elected president of that organization at a meeting of the Board of Directors held February 7. **Dr. Paul D. Merica** succeeds Dr. Thompson as executive vice-president and **H. S. Wingate,** secretary since 1939, becomes a vice-president in addition to his duties as secretary.

Harold S. Dunn, Pittsburgh district manager of the Harbison-Walker Refractories Co., Pittsburgh, has been appointed general sales manager. Mr. Dunn has been district sales manager since August, when he was promoted from sales manager of the Portsmouth, Ohio, district. He holds A.B. and M.A. degrees from Ohio State University, where he was a Phi Beta Kappa. He has been with Harbison-Walker since 1925.

R. B. Brown, formerly with the Eclipse-Pioneer Division of Bendix Aviation Corp., was recently appointed executive vice-president and general manager of The Magnesium Association at a meeting of the Association's Board of Directors.

Robert E. Rielly has joined The Chas. Taylor Sons Co., Cincinnati, as assistant to the vice-president in charge of sales. Mr. Rielly will assist in supervision of the company's national advertising program, as well as in sales duties.

Dr. Harry P. Croft, former director of technical control and research for Chase Brass & Copper Co.'s Midwestern division, has been named vice-president in charge of development of the Wheeling Bronze Casting Co., Moundsville and Wheeling,

Dr. H. P. Croft

W. Va. Dr. Croft served as a private in World War I, and as chief of the Industrial Division of the Cleveland Ordnance District with rank of colonel during World War II.

William Ciancio of the Midwest Foundry Supply Co., Denver, has been appointed treasurer of the A.F.S. Timberline Chapter, to fill a vacancy caused by the resignation of **Alvin O. Gruenwald,** Manufacturers' Foundry Corp., Denver.

Professor Thomas K. Sherwood, Dean of Engineering, Massachusetts Institute of Technology, and **Dr. Bruce S. Old,** a member of the staff of Arthur D. Little, Inc., were recently elected to the Board of Directors of Arthur D. Little, Inc., Cambridge, Mass., research and engineering organization. Simultaneously it was announced that **R. C. Griffin,** assistant secretary and a director of the company, retired under the company's compensation plan.

Three changes in personnel announced by the Mathieson Chemical Co., are: **Roland F. Boehm,** formerly Houston, Texas, sales manager, transferred to the

Ammonia department; **O. J. Theobald, Jr.**, formerly Charlotte, N. C., sales manager, to replace Mr. Boehm in the Houston office; and **J. F. Carey**, formerly sales representative in the Charlotte office, to replace Mr. Theobald as sales manager there.

Sam Tour & Co., Inc., New York, announces the reorganization of its Mechanical Engineering Department under the supervision of **John J. Meadows**, who recently joined the organization after 30 years' experience in electrical and mechanical engineering. Mr. Meadows is the inventor of several devices that have been used by the Army and Navy and has several patents pending.

F. K. Donaldson

Fred Kermit Donaldson, vice-president, general manager and treasurer of the Machined Steel Castings Co., Alliance, Ohio, became executive vice-president of the Steel Founders Society of America on April 1. Mr. Donaldson, who has resigned to devote his full time to his new position, is a son of the late Fred R. Donaldson, one of the founders of Machined Steel Castings Co., and began as a draftsman with that organization in 1919. He served as president of the Steel Founders Society of America in 1948.

William H. Worrilow, president of Lebanon Steel Foundry, Lebanon, Pa., was recently guest of honor at the 1949 Pacific Coast Dinner of the Newcomen Society of England, and spoke on the life of one of California's pioneer statesman and civic leaders, James Lick, for whom the Lick Observatory is named.

Adolf H. Schott, vice-president of the Standard Brass Works, Milwaukee, retired February 5, after more than a half-century with Standard and its predecessor company, Werner-Schench Co. Mr. Schott joined Werner-Schench at the age of 17 as a laborer at $6 per week. He was made vice-president of the company in 1914.

William J. Grede, president of Grede Foundries, Inc., Milwaukee, has been appointed chairman of the Federal Debt Management Committee of the National Association of Manufacturers—formed early this year to study problems created by the current Federal debt. Mr. Grede is a director of the NAM and a past president, Employers' Association of Milwaukee.

Dr. J. G. Haenel, head of the Mechanical Testing of Metals Department of the Instituto de Pesquisas Tecnologicas, Sao Paulo, Brazil, has been appointed editor of Mineracao e Metalurgia (Minerals and Metallurgy), publication of the Brazilian Metals Association. He will also continue in his present duties at the Instituto de Pesquisas Tecnologicas.

V. S. Spears of the American Wheelabrator & Equipment Corp., Mishawaka, Ind., formerly secretary of the A.F.S. Michiana Chapter, has been appointed Chapter vice-president to fill the unexpired term of **John Rush**, Elkhart Brass Mfg. Co., Elkhart, Ind., who recently resigned his office. Mr. Spears will be replaced as secretary by **J. Paul Jordan**, Dodge Mfg. Corp., Mishawaka, Indiana.

Dr. G. V. Slottman has been appointed director of Research and Engineering for the Air Reduction Co., Inc., New York. Dr. Slottman, who joined Air Reduction in 1934, served as manager, Technical Sales Division, and in 1948 was appointed technical assistant to the vice-president in charge of Sales, a position he held until his present appointment. He is a graduate of Massachusetts Institute of Technology, and received his doctor's degree from the University of Berlin in 1927.

G. O. Romig has been appointed sales manager of the Cleveland plant of the Claud S. Gordon Co. Mr. Romig joined the company as sales engineer in 1945 after three years' service with the Army.

O. R. Schroeder, formerly director of metallurgical research for the Great Lakes Steel Corp., has been appointed vice president of development and engineering for the Weldaloy Products Co., Cleveland. Mr. Schroeder has been instrumental in the development of resistant welding processes for special low alloy, high tensile and other steels carried out in conjunction with Rensselaer Polytechnic Institute's welding research laboratory.

Edmund B. Kinne has been appointed product engineer for McConway & Torley Corp., Pittsburgh. Mr. Kinne, who has been with the company since 1943 was formerly production engineer and assistant to the general superintendent. Before joining McConway & Torley he was assistant chief inspector of the Chicago plant of American Steel Foundries, and from 1940 to 1943 was assistant manager in charge of production at that firm's Pittsburgh and Verona plants.

John R. Russo, a director of the A.F.S. Northern California Chapter, and formerly vice-president in charge of national sales for the General Foundry Service Corp., San Francisco, resigned January 1 to form the Russo Foundry Equipment Co., with headquarters in Oakland, Calif. Mr. Russo will act as West Coast manufacturers' agent for the International

John Russo

Molding Machine Co., La Grange Park, Ill.; Illinois Cereal Mills, Paris, Ill.; and the Velsicol Corp., Chicago, among others.

Robert L. Springer, formerly assistant manager of the Chicago District of Firth Sterling Steel & Carbide Corp., has been appointed Chicago manager.

George R. Gibbons, senior vice-president and a director of the Aluminum Co. of America, retired as an officer of the company on January 1. He will continue to serve on the Board of Directors.

Elected as officers of the Associated Industries of Cleveland, an organization of more than 1,000 local manufacturing concerns, recently were president, **James L. Myers**, president of the Cleveland Graphite Bronze Co.; vice-president, **A. E. Gibson**, president of the Wellman Engineering Co.; and treasurer, **Claude E. Murray**, executive vice-president, Willard Storage Battery Co.

Robert D. Dodge has been appointed a Michigan sales representative for the Core Oil Division of the Werner G. Smith Co. (Division of Archer-Daniels-Midland Co.) Mr. Dodge attended Michigan State University and worked for the Ford Motor Co. before joining Werner G. Smith. He has recently completed a training program in the company's Foundry Research Laboratory, Minneapolis, and will work under his father, **Frank H. Dodge**, who has represented Werner G. Smith in Michigan for 33 years.

Three new engineers appointed to the technical staff of the Sterling Grinding Wheel Division, Tiffin, Ohio, are: **Robert G. Fries** and **George Brannick, Jr.**, who will work in the laboratory as part of the Division's new development program, and **John B. Riddle**, who will be plant engineer at Tiffin.

Kempton Dunn and **Cyrus E. Brush** were elected vice-president and secretary, respectively, of the American Brake Shoe Co. at the February meeting of the com-

(Continued on Page 174)

WHO'S WHO

G. H. Found

George H. Found, author of *"Design Light Metal Castings,"* Page 91, has written many articles for the technical press on the metallurgy of magnesium . . . A graduate of Princeton University, he was awarded a Yale Fellowship and received his doctorate in Metallurgical Engineering there in 1943 . . . He has been a metallurgist with Bell Telephone Laboratories, New York City, and New Jersey Zinc Co., Palmerton, Pa., prior to assuming his present position as metallurgist for the Dow Chemical Co., Midland, Mich., in 1943 . . . Dr. Found is a member of A.F.S., AIME, ASTM, ASM and SESA.

A. M. Montgomery

A. M. Montgomery, author of *"Metallography of Aluminum Casting Alloys,"* Page 115, is chief metallographist of the Cleveland Works of the Aluminum Company of America . . . Holder of a B.S. in Metallurgical Engineering and an M.S. in Metallurgy from the Carnegie Institute of Technology, Mr. Montgomery joined Alcoa as a metallographist in 1939, becoming chief metallographist, his present position, in 1940 . . . He is a past president of the Foreman's Club of the Alcoa Cleveland Works, and a member of the executive committee of the Cleveland Chapter.

E. C. Zuppann

Edward C. Zuppann, co-author with A. E. Martin of *"Fast Analysis of Acid Slags,"* Page 126, is technical inspection supervisor for the Wilson Foundry & Machine Co., Pontiac, Mich. . . . Holds B.S. and M.S. degrees from the University of Minnesota in Metallurgy . . . Mr. Zuppann began his career as plant metallurgist for the American Steel Foundry, Indiana Harbor, Ind., in 1939 . . . After two years as an open hearth observer for the Carnegie-Illinois Steel Corp., in 1940-42, he joined the LeTourneau Co., Toccoa, Ga., as general melting foreman, leaving there to join the Navy as a lieutenant, J.G. . . . After the war, Mr. Zuppann became an instructor in Metallurgy at the University of Minnesota for a year, and in 1947 joined Wilson as cupola foreman and night metallurgist . . . He was appointed to his present position as technical inspection supervisor in 1948 . . . Mr. Zuppana is a member of A.F.S., ASM, and the American Society of Naval Engineers.

A. E. Martin

Allan E. Martin, co-author with E. C. Zuppann of *"Fast Analysis of Acid Slags,"* Page 126, is assistant professor of Metallurgy at the University of Minnesota . . . A graduate of that institution in 1935, he did graduate work there and at Pennsylvania State College until 1940, when he became an instructor in Metallurgy at the Carnegie Institute of Technology . . . He has been an assistant professor at the University of Minnesota since 1942, with the exception of a two-year period spent on the Manhattan Project at the University of Chicago and at the University of California's Los Alamos, N.M., laboratories. He is the author of several articles appearing in the technical press on various phases of metallurgy.

H. W. Zimnawoda

Henry W. Zimnawoda, author of *"Six ways to Mechanize a Foundry,"* Page 79, is a native of Poland and a graduate of the University of Danzig . . . Became assistant to the superintendent of a Warsaw foundry a year after graduating from college in 1928 and by the time he left that position in 1939 had become foundry manager . . . Mr. Zimnawoda then worked as a foundry engineer in Paris, France, for a year, then spent three years in Sao Paulo, Brazil, as assistant foundry manager for Eleavadores Atlas Co. . . . In 1944, Mr. Zimnawoda came to the United States, working as foundry engineer first at the American Steel Castings Co., Newark, N. J., and later at Bendix Aviation Corp.'s Teterboro, N. J., aluminum and magnesium foundry . . . Since 1946 Mr. Zimnawoda has been in charge of the Export Department of the National Engineering Co., Chicago.

L. Schmidt

Louis Schmidt, author of *"Cast Large Aluminum Wheel,"* Page 133, is pattern foreman at the Aluminum Company of America's Cleveland plant, where he has worked in the Pattern Shop for more than a quarter of a century . . . Mr. Schmidt began as an apprentice patternmaker with Alcoa in 1923, attending West Technical High School, Cleveland, nights during his apprenticeship . . . He was appointed to his present position in 1944. Mr. Schmidt has spoken before several meetings of technical societies on patternmaking processes.

H. N. Bogart

Harold N. Bogart, co-author with Gosta Vennerholm of *"Effect of Slag Types on Heat Treatment of Malleable Iron,"* Page 96, is research metallurgist for the Ford Motor Co., Dearborn, Mich. Holder of a B.S. in Chemical Engineering from Michigan State College in 1937, Mr. Bogart joined Ford Motor Co. the same year as an analyst . . . A member of A.F.S., ACS and ASM, he has written for the technical press and has spoken before several A.F.S. chapters on Metallurgy.

G. Vennerholm

Gosta Vennerholm, co-author with H. N. Bogart of *"Effect of Slag Types on Heat Treatment of Malleable Iron,"* Page 96, will be awarded the Wm. H. McFadden Gold Medal at the 53rd Annual A.F.S. Convention "for outstanding contributions to ferrous and non-ferrous metallurgy practice." Swedish-born, Mr. Vennerholm is a graduate of Technical College, Stockholm . . . After studying and teaching metallurgy in Germany, Mr. Vennerholm came to the United States in 1924

to join Ford Motor Co. as a member of the staff of the company's physical laboratory . . . He has been with Ford since, including five years spent as metallurgist and supervisor of installations at Ford's Dagenham, England, plant, and is today supervisor of metallurgical research of Ford Motor Co.


M. G. Dietl

Martin G. Dietl, author of "*Problem of Gases in the Indirect-Arc Furnace,*" Page 99, was born in Berlin, Germany, but came to this country at an early age, attending grammar and high school in East Orange, N. J. . . . A graduate of Newark College of Engineering in 1938, he has done some post-graduate work in Metallurgy at the Illinois Institute of Technology . . . While at Newark College, Mr. Dietl did cooperative student work at American Steel Foundries, Newark, N.J. . . . In 1938, Mr. Dietl joined Crane Co., Chicago, as a student, later becoming sand technician, metallurgist and, in 1945, melting foreman, his present position.

A. F. S. Employment Service

To contact firms seeking personnel through "Help Wanted" or persons seeking "Positions Wanted" items write to American Foundrymen's Society, 222 West Adams St., Chicago 6, designating Item Number.

HELP WANTED

HW506 — Aluminum Permanent Mold Foundryman: Take complete charge of new foundry. Preferably automotive piston experience. Knowledge of mold design desirable. Write giving experience and salary wanted.

POSITION WANTED

PW109 — Metallurgist-Physicist: Extensive training and experience in ferrous and non-ferrous foundry problems. Physical testing, metallography, radiography, x-ray diffraction, spectroscopy, heat treating, magnetic particle testing. Slag and refractory research. Management of research and production control laboratories. Capable heading laboratory for theoretical research problems. Last position was chief consulting engineer. Will go almost anywhere.

PW110—Foundry Manager: Desire connection with progressive non-ferrous foundry. Capable of supervising all foundry operations including estimating, selling, pattern layout, cost and production control. Specialized past seven years in production of high pressure brass sand castings and aluminum castings. Age 44, married, three children.

PW111—Metallurgist or Superintendent: 10 years experience in gray iron metallurgy and supervision; molding, melting, pouring, mechanical maintenance. Jobbing and production castings, ½ lb to 8 tons; machine tools, agricultural, automotive, pressure castings. Know cupola operation, fuel substitution, natural and synthetic sands, facing materials, all types molding equipment. Chemical engineering degree. Available immediately for research or production.

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Letters to the Editor

The Malleable Foundryman And Nodular Cast Iron

The development of nodular cast irons has been causing some concern among producers of black heart malleable iron. Iron castings possessing the desirable combination of high strength and good ductility associated with the spherical form of free graphite have up to now been commercially produced only as a result of heat-treatment of castings which possess no free graphite as cast, and it would now seem that some foundrymen are assuming that such castings can be produced by any well-operated gray iron foundry, thus nullifying the value of existing investment in equipment for annealing malleable iron.

However, considered appreciation of the many factors involved suggests that for the present at least, and probably for some time to come, the advent of nodular cast irons is not a serious threat to the position of producers of black heart malleable iron, and is likely to be of appreciable benefit.

The two methods at present being used to produce nodular or spherical graphite in iron as cast are fundamentally, treatment of the molten cast iron with cerium or cerium-containing alloy, and treatment with magnesium or magnesium containing alloy. Both methods are effective, and high mechanical strength and impact resistance are obtainable in the iron as cast, with ductility being improved by heat treatment. An unusual feature is that high strength is maintained in heavy sections up to 6 in., with sections lighter than ¾ to 1 in. possibly presenting more difficulty than heavier sections.

Neither of the treatments is low in cost since certain limitations in base metal composition must be met, the alloying or treatment additions involve expense, and ductility approaching that of malleable iron is obtainable only as a result of heat-treatment of the treated iron. Exact data on over-all costs of either method are not at present available, since a great deal must still be learned about methods of addition of alloys, foundry properties, and consistency of results. However, assessment of all available information indicates that treatment costs are likely to be appreciably higher than the cost of annealing black heart malleable iron, and that the cost of a given casting in nodular cast iron, especially at higher ductility, is and probably will be for some time, higher than the cost of the same casting in malleable iron.

An important consideration is that the large majority of malleable iron castings have section thicknesses less than ¾ in., and in fact as section thickness decreases down to the point where molten iron fluidity becomes a factor, annealing cycles for malleable iron become shorter and less expensive, and mechanical properties and ductility improve. In this field it appears likely that competition of other materials with standard malleable iron will be difficult on the basis of optimum properties at lower cost.

With respect to heavier sectioned work, 2 in. and more in thickness, the new developments should be of important benefit to malleable iron foundries, since they make possible the production of heavy sections in ductile iron that have until now not been feasible. Since the best ductility of the nodular cast irons is obtainable only after heat-treatment, and since malleable iron foundries are well versed in such annealing treatments, the adoption by malleable iron foundries of techniques for producing nodular cast irons—especially in heavy sectioned work—is a logical development that should extend the field of operations of malleable foundries.

To summarize, it is felt that undue concern should not be felt over the future of the malleable iron industry in the United States and Canada as a result of development of nodular cast irons, but rather that more benefit than harm should ensue since the malleable foundries would seem to be in the best position to exploit these new irons. The field of standard malleable iron should be extended by increased consumer appreciation of the value of ductility and shock resistance, and the sphere of operations of malleable iron foundries will be extended by the fact that the nodular cast irons make possible heavy sectioned castings in a shock-resistant, ductile iron.

For the future, the sensible course for the malleable iron founder would seem to be to keep production costs low and quality high in the standard malleable iron product, and to keep abreast of developments in nodular cast iron with the object of applying and using them to enlarge the range and value of his product.

J. E. Rehder, *Foundry Engineer*
Canadian Bureau of Mines
Ottawa, Ontario

"The Foundrymen's OWN Magazine" publishes herewith its fifth document on nodular graphite cast iron and invites submission of additional letters and technical papers from all interested in the subject. —Editor.

Early A.F.A. President Recalls Old Timers

The group picture of old timers (American Foundryman, January, 1949, page 62) was taken on the steps of one of the buildings of Columbia University, New York, during the 1905 Convention there.

Of particular interest to me are: 1. It was my first A.F.A. Convention; 2. The man on my immediate left, the late Ed McLean of Altoona, Pa., became my father-in-law; and 3. The little girl in the front row on the extreme right whom I did not meet until a couple of years after, the late Jane McLean Anthes, became my wife. Our only daughter, named after her mother, will be 33 on her next birthday.

While there are many in the group whom I knew, my memory for names is not what it used to be. Some of those pictured are: Dr. and Mrs. Moldenke, Chris Wolff, President for that year, Tom West, incoming President, Ben Fuller, Henry Lane, Messrs. Parry, McCormick, Hubbard, Smith, Taylor, McClintock, Pridmore, Sly, Field, Carr, Knabel, Gilmour, Hill, Wadsworth and Cayley. I knew many more but cannot remember the names.

I hope to be able to attend the St. Louis Convention, to meet again some of my old friends.

L. L. Anthes, *President*
Anthes-Imperial, Ltd.
Toronto, Ontario
President of A.F.A. 1908-09

They Will Remember A.F.S.

A.F.S. is to be commended for the good work it is doing for the foundry industry and particularly for its splendid efforts to keep the members well posted in the industry's progress.

George S. Linberg
Campbell, Wyant & Cannon Fdry. Co.
Buffalo, N. Y.

Thank you for your kind words. My associations with A.F.A. (as it will always sound to me) have, as you say, extended over many years and I count them among the most pleasant and rewarding of my experiences.

Arthur H. Jameson

A foundry industry old timer, Mr. Jameson retired at the end of 1948. Formerly sales manager of Malleable Iron Fittings Co., Branford, Conn., he represented the company as a sustaining member of A.F.S. —Editor.

Contact Foundation For Men

The Foundry Educational Foundation has noted that virtually all the students who worked in foundries last summer intend to return, either for summer or permanent foundry work at the close of the present school term early in June.

This is more significant than any of the many other indications of the favorable acceptance of the industry by engineering students for their careers. Some of the students have been critical of some segments of the industry for an apparent lack of plan and vague intentions as to their future use of engineering talent. These students, however, and their advisers at the universities know that training programs for college graduates have only recently started to become general in the foundry industry and that many rough spots still need to be ironed out.

Already over 50 companies have registered with the Foundation as having openings for graduating engineers or summer student workers. Over 300 students are being placed in contact with the industry,

with more than 100 available for permanent positions.

Several opportunities are being offered by Southern foundries in connection with the recently announced program at the University of Alabama, scheduled for inauguration in September, 1949. Laboratory building and service facilities are being provided by the University and by the foundry industry in that area under the leadership of James T. MacKenzie and Stephen Moxley, both of American Cast Iron Pipe Co., and L. N. Shannon, Stockham Valves & Fittings, Birmingham, Ala.

George K. Dreher, *Exec. Director*
Foundry Educational Foundation
Cleveland

A Foundry With A Future

The story of GI training at Frederick Iron & Steel, Inc., is one of success, reflected by the company's increase in production and in number of skilled personnel.

The veterans training program has been in effect with us for over three years and was prompted by the scarcity of trained molders and coremakers.

We consulted the local USES office and finally started six veterans as helpers to six experienced squeezer operators, men in the 50-70 years of age bracket. The latter apparently did not relish the prospect of training the youngsters but we convinced them of the need for training new men if we were to increase production which was absolutely necessary for successful operation.

For about two weeks these six GI trainees spent most of their time doing miscellaneous tasks required by squeezer operators. Within two to three weeks, the six were put on machines of their own and a trained operator assigned to spend his time with them, showing each how to effectively handle his machine and how to make a perfect mold. Observing progress, we called upon the employment service for 12 more GI's and used the same method on the small rollover and later on the large rollover. Results continued good and we kept increasing the group until we had more than 70 GI trainees scattered throughout the entire foundry on bench work, squeezers, small rollovers, large rollovers, floor work and pit work.

During this training program, we were confronted with numerous difficulties. Our scrap production increased and we commenced making bad castings wholesale. Our costs increased, our losses mounted.

Reluctant to abandon the program without another try, we held a meeting in the office and listened to each boy's story. Each boy had an opportunity to tell us what he thought was wrong, what he didn't like about our system and where he thought we were not in line.

The next thirty days showed progress and the ensuing time clearly demonstrated that what we originally lacked in our training program was sufficient individual supervision. We corrected this by personally talking to the men, by encouraging some to pay closer attention, by convincing the older experienced molders and coremakers that training these youngsters like they would their own sons would make the program a success for us all.

The progress that has been made in the training of the GI's at our plant has encouraged the government to institute a night school where the GI's spend 144 hr of their training time, twice a week in 2 hr periods. They are taught mathematics, blueprint reading, molding, sand preparation and other things that will help with their in-plant training. The government employs teachers composed of the key men of our plant who spend their time at the high school with the trainees in still further fitting them for their trade.

What has happened in Frederick Iron & Steel, Inc., can happen in any foundry anywhere in the United States.

Jacob Goldberg, *President*
Frederick Iron & Steel, Inc.
Frederick, Md.

It's A Monthly Feature

The way you presented the method of making a one piece bronze model turbine runner in Modern Foundry Methods (American Foundryman, January, 1949, pages 52-54) was excellent and that opinion is shared by all the Dominion Engineering Works, Ltd., staff who read the article.

H. W. Bennett, *Apprentice Supv.*
Dominion Engineering Works, Ltd.
Lachine, Quebec

May I add my compliments on the picture story showing the molding of a model turbine runner. I hope you will run more of these as it is certainly a graphic representation of a subject which could be confusing in words alone.

George K. Dreher, *Exec. Director*
Foundry Educational Foundation
Cleveland

Gave Him Wrong Title

In connection with my paper, "*Controlled Cooling of Ferrous Castings,*" American Foundryman, December, 1949, pages 60-62, you have stated in the Who's Who section that "when the company (Fabricas Volcano e Colares) was purchased by Companhia Uniao Fabril in 1945, Mr. Pedroso became chief engineer.

This should have been: When the company was purchased by another firm (not CUF) in 1945, Mr. Pedroso joined Companhia Uniao Fabril as chief engineer of Barreiro Metallurgical Works.

E. I. Pedroso, *Chief Engineer*
Barreiro Metallurgical Works
Companhia Uniao Fabril
Barreiro, Portugal

Problem In Foreign Exchange

I find that you have published a technical reference, Cast Metals Handbook, for those engaged in the casting of metals. Will you kindly forward a copy for use as a guide in my daily practice and a substantial help to my work in the technical education program of this country. Unfortunately, I don't have a deposit in U. S. currency or a bank draft in U. S. funds at present. As you know, all the foreign exchanges in China are under government control, therefore I can hardly apply for a certain amount of it to pay for Cast Metals Handbook. May I offer several sets of Chinese memorial stamps selected from my collection to pay for the book?

C. S. Wei
Shanghai, China

Through special arrangements and in consideration of the very fine stamps enclosed—which the A.F.S. auditors probably would not consider as "payment received"—a *Cast Metals Handbook* has been sent to Mr. Wei.
—Editor.

Foundry Training Pays Off For Veterans And For Plant

Former trainees of Frederick Iron & Steel, Inc., have developed skills which enable them to make castings weighing up to 3000 lb on a larger rollover molding machine. These and other veterans from the Frederick (Md.) area where the plant is located like their work and are earning a good livelihood.

CHAPTER ACTIVITIES NEWS

Chesapeake

Jack H. Schaum
National Bureau of Standards
Chapter Reporter

January was a busy month for the Chapter. Early in the month, a large group of members and their guests attended the Chapter's Gala Oyster Party at the Club Alcazar on January 8.

At the January technical meeting, members divided into three groups for discussions on non-ferrous alloys, cast iron and steel.

Under the leadership of Robert Colton, American Smelting & Refining Co., the problems associated with production of yellow brass hardware, high-lead castings, and high conductivity copper were discussed. Mr. Colton emphasized the importance of control of O_2 and H_2 pickup during melting. Fred Fay, Landis Tool Company, guided the gray iron discussions, which centered around cupola operations. Some of the subjects touched on were the effect of blast on composition and temperature of the metal, charging coke and anthracite coal, and the use of soda ash. The steel round table was headed by E. C. Troy, National Engineering Co.

Just preceding the round table conferences, Commander R. H. Lambert, U. S. Navy, entertained the foundryman with first hand experiences with requirements for castings on Navy fighting ships where human lives and the country's welfare are depending on good quality castings.

Northwestern Pennsylvania

James J. Farina
American Sterilizer Co.
Chapter Reporter

"Top Management Night" was the designation of the well-attended February 28 meeting, held at the Moose Club, Erie.

Max Kuniansky, Lynchburg Foundry Co., and Past President of the American Foundrymen's Society, was technical speaker. His subject was *"Foundry Management"*.

Mr. Kuniansky spoke of the great strides made in metallurgy since 1920. He inserted a humorous note in his talk when he stated that in spite of the know how, mechanization, and controls, they still made scrap at Lynchburg. The only difference was that they made it the scientific way.

Dana E. Jones, secretary of the Manufacturer's Association of Erie, Pa., was coffee speaker. Mr. Jones spoke about the local city government and its tax program, and how it will affect local manufacturers.

Central Ohio

H. W. Lownie, Jr.
Battelle Memorial Institute
Chapter Reporter

The February 14 meeting featured addresses by Dr. C. H. Lorig, Battelle Memorial Institute, and N. J. Henke, Central Foundry Division, General Motors Corp., Saginaw, Mich.

Dr. Lorig spoke to the Steel Group on *"The Heat Treatment of Steel Castings"*. A brief review was given of the more common methods of heat treatment of steel castings and was followed with a description of the application of Jominy hardenability and the use of continuous cooling data for assessing different types of steel castings. The principal purposes of heat treatment were given as (1) to recrystallize the steel to refine the coarse as-cast structure, and (2) to homogenize the steel to correct segregation which occurs during freezing.

The importance of the structure of cast steel, and the dependence of mechanical properties upon structure, were illustrated by a number of slides. It was pointed out that the structure obtained at different rates of cooling from a temperature above the critical temperature is dependent on base composition and alloy content, which in turn determine to a large extent the hardenability of the steel. Only a few of the elements in steel, such as carbon and hydrogen, diffuse with ease, other elements, such as manganese, nickel, and phosphorus, which are especially prone to segregate, diffuse slowly in steel and then only at

Robert Spurgin, left, Swayne-Robinson Co., a newly-elected director of the Central Indiana Chapter, photographed at the March 7 meeting with, left to right, Chapter Chairman Robert Langsenkamp, Langsenkamp-Wheeler Brass Works; Visitor Howard Voorhees, Peru Foundry, Peru, Ind., director and past chairman of Michiana Chapter; and A. F. S. National Director-Nominee V. J. Sedlon, Master Pattern Works, Cleveland, the speaker.

high homogenizing temperatures.

Because there is practically no fundamental information regarding the transformation of austenite in cast steels for different rates of continuous cooling from heat-treating temperatures, the heat treater in foundries is obliged to rely mainly upon his judgment as to the heat-treating schedule he shall use to obtain a desired result. When such fundamental information becomes available, commercial foundries will be able to improve the results obtained during the heat treatment of steel castings.

Mr. Henke addressed the Malleable Iron Group on the subject of *"Foundry Educational Programs"* and emphasized the need of training programs and educational activities both within and without the foundry industry. He pointed out that of the fifty thousand engineering graduates from 125 schools in 1948, only seven thousand had any contact with the foundry, and of these, less than 100, or less than 0.2 per cent went into the foundry industry, the fifth largest durable goods industry.

Vice-Chairman R. J. Wilcox, Michigan Steel Castings Co., A.F.S. National President W. B. Wallis and Chapter Chairman A. W. Stolzenburg, Aluminum Co. of America, relax during Detroit Chapter's March 4 meeting.

Zigmund Madacey, left and Chapter Chairman F. W. Shipley, both of Caterpillar Tractor Co., flank speaker Carl F. Joseph, Central Foundry Division, General Motors Corp., at the February 7 meeting of the Central Illinois Chapter.

Mr. Henke suggested that technical training can well be started at the top supervisory level in many plants and carried down through the organization. Such training programs should be set up with a definite and concrete program based upon the practical requirements of the organization, and should be so set up that the training program does not break down into a series of unrelated bull sessions.

Important technical developments of the last 30 years were reviewed by Mr. Henke and the following developments were outlined as being the most likely useful developments for the future; use of oxygen as an aid in melting, ultrasonic processes for dust control, treatment of coke to reduce ash content, better methods of chemical analysis, manufacture of duplicate patterns, elimination of seacoal, high-frequency heat treatment, ultrasonic inspection of castings, automatic molding, dielectric core baking, precision casting, and an effective program to make the foundry a better place to work.

Chief W. G. Strickfaden of the Columbus Fire Department presented a coffee talk on the growth of the Columbus Fire Department, and related some interesting stories of old-time firefighters in the early days of Columbus.

Washington

Fred R. Young
E. A. Wilcox Co.
Chapter Secretary

The Engineering Experimental Station of the University of Washington was open to members of the Washington Chapter at the February 18 meeting, held at the Men's Faculty Club on the University of Washington campus.

The meeting opened with intro-

Members and speakers seated at the speakers' table at Central Ohio Chapter's February meeting.

Representatives of companies holding sustaining memberships in A.F.S., who were honored at the February meeting of the Cincinnati District Chapter are, left to right around table: Robert Cory, Hamilton Brass & Aluminum Foundry Co.; Peter E. Rentschler, Hamilton Foundry & Machine Co.; A. L. Grim, Dayton Malleable Iron Co.; A. Oberhelman, Ritter Foundry Co.; J. Herkenhoff, Munster Machine Co.; W. J. Buringer, Buckeye Foundry Co.; and J. M. Kane, American Air Filter Co., Louisville, Ky.

ductory remarks by Professor Schaller and an address of welcome by Dean Wissman, both of the University's Engineering School.

George K. Dreher, executive director of the Foundry Educational Foundation, was the principal speaker of the evening. His topic was *"The Why of Engineering Education."*

Following Mr. Dreher's address, there was a demonstration of the University's new testing machine. A sample cast iron billet 20 x 6 in. was compression tested, and reached the 2,400,000 lb limit of the machine without fracturing. This was followed by a demonstration of an electronic microscope.

Tennessee
Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

"Youth Encouragement" was the subject of Speaker A. W. Gregg, Whiting Corp., Harvey, Ill., at the February 25 meeting.

The most important problem facing the foundry industry today is the need for "new blood", Mr. Gregg said. From these men will come the industry's leaders of tomorrow, he added, and it is up to foundries to make every effort to secure college-trained personnel for this purpose.

Mr. Gregg cited the results of a questionnaire offered a senior class in an engineering college. As an example, he said, students replied that they preferred work in atomic energy 12 to 1 over the foundry, 44 per cent preferred to use other methods of making machine parts as opposed to castings. Those students who had visited foundries reported such impressions as "dirty", "dark", "badly-ventilated", "drudgery", etc.

If this is the attitude of college men, Mr. Gregg said, it is high time something is done by the industry to "clean house" and to interest these young men in foundry work. It is with this in mind that the Foundry Educational Foundation was created two years ago, and it is doing much to rectify these conditions.

In a general discussion period following the address, Mr. Gregg answered many questions asked by prominent Tennessee foundrymen and educators on the work of the FEF and the efforts of foundry technical societies to improve working conditions in the industry.

Detroit
A. B. Allen
Penton Publishing Co.
Chapter Reporter

Discussion of *"Preventive Maintenance in the Foundry"* was one-half of a "twin bill" technical program at the March 17 meeting.

The latter half of the program consisted of an address by Lester B. Knight, Lester B. Knight & Associates, Inc., Chicago, who presented a study of the economics of plant modernization.

At the dinner preceding the technical program, Dr. Robert S. Drews of Detroit spoke on *"What is a Normal Person?"*

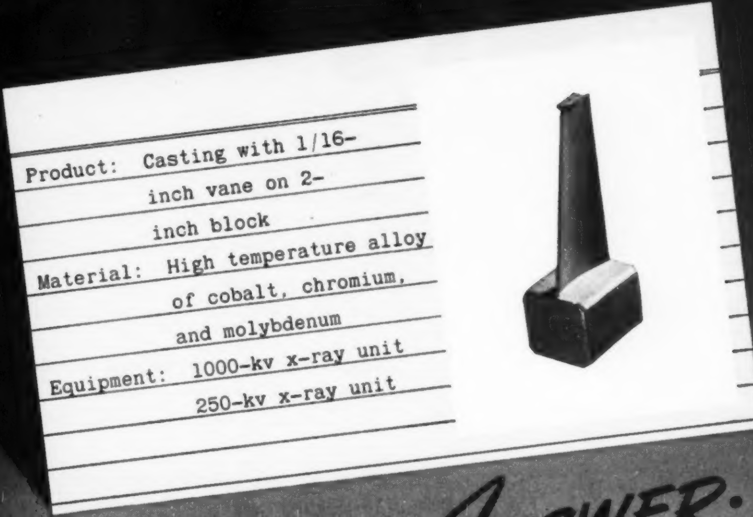
Central Indiana
W. K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

Approximately 135 members and their guests attended the March 7 meeting, held at the Athenaeum,

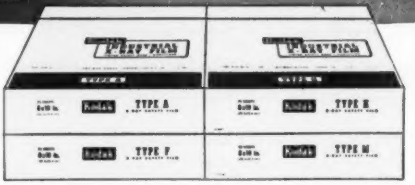
(Continued on Page 160)

In this discussion group following the February meeting of the Eastern New York Chapter were, left to right: R. H. Croft, Magnus Metal Co.; J. H. Wheeler, Wheeler Bros.; Speaker B. A. Miller, Baldwin Locomotive Co., Philadelphia; Eastern New York Chairman Alexander Andrew, American Locomotive Co.; and L. W. Scully, Scully Foundry & Machine Co.

WHAT'S THE RIGHT X-RAY FILM?



ANSWER:



KODAK INDUSTRIAL X-RAY FILM, TYPE M

In examining this casting, the radiographer used Type M Film because it provides maximum radiographic sensitivity. Its speed is adequate so that the million-volt unit got through the two-inch base block with reasonable exposure, while the 250-kv unit proved sufficient for the thin vane. The high contrast and detail-resolving ability of Type M revealed clearly the thread-like cavities present in the casting.

A TYPE OF FILM FOR EVERY PROBLEM

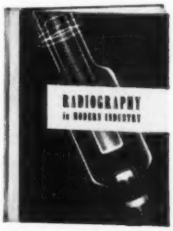
To provide the recording medium best suited to any combination of radiographic factors. Kodak produces four types of industrial x-ray film.

Type M provides maximum radiographic sensitivity, high contrast, and exceptional detail under direct exposure or with lead-foil screens. It has extra fine grain and the speed is adequate for examination of light alloys at average kilovoltage and for much million-volt radiography of thin steel and heavy alloys.

Type A offers high contrast with about three times the speed of Type M, but with slightly more graininess. Used direct or with lead-foil screens for study of light alloys at low voltages, and of heavy steel parts at 1000 kv.

Type F provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

Type K has medium contrast with high speed. For gamma-ray and x-ray work where highest possible speed is needed at available kilovoltage without use of intensifying screens.



RADIOGRAPHY IN MODERN INDUSTRY

A wealth of invaluable data on radiographic principles, practice, and technics. Profusely illustrated with photographs, colorful drawings, diagrams, and charts. Get your copy from your local x-ray dealer—price $3.

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New AFS MEMBERS

Period February 15-March 15: New A.F.S. members for the second period of 1949 number 82, including three company members. The Northeastern Ohio Chapter, with 12 new members, had the greatest gain for the period.

NEW COMPANY MEMBERS

Bay City Sand Co., Bay City, Wis.—Arthur A. McHardy, Co-Owner & Co-Operator (Twin City Chapter).

Linmold Co., Compton, Calif.—Linne Nelson, Part-Owner (Southern California Chapter).

Fire Brick Service & Supply Co., Cleveland—L. A. Cutter, Pres.-Mgr. (Northeastern Ohio Chapter).

BIRMINGHAM CHAPTER

Clyde D. Wood, Jr., Mgnm. Trainee, U. S. Pipe & Foundry Co., Bessemer, Ala.

CANTON DISTRICT CHAPTER

T. E. Anderson, Sls. Repr., Ohio Ferro-Alloys Corp., Canton, Ohio.

CENTRAL INDIANA CHAPTER

Sam Hodler, Melt. Supt., Golden Foundry Co., Columbus, Ind.
Russell E. Jones, Asst. Prod. Mgr., National Malleable & Steel Castings Co., Indianapolis.
Joseph J. Vallette, Sls., The United States Graphite Co. Div., Wickes Corp., Indianapolis.

CENTRAL MICHIGAN CHAPTER

William A. Atchison, Fmn. Melt. Dept., Centrifugal Fusing Co., Lansing.

CENTRAL NEW YORK CHAPTER

Peter F. Connell, Fmn. of Brass Melting, Oberdorfer Foundries, Inc., Syracuse, N. Y.
William C. Dunn, Chemist, Oberdorfer Foundries, Inc., Syracuse, N. Y.
Sverre Gahr, Student, Syracuse University, Syracuse, N. Y.
Augustus Perrotto, Brass Fdy. Fmn., Goulds Pumps, Inc., Seneca Falls, N. Y.

CENTRAL OHIO CHAPTER

John McL. Bayliss, Refractory Engr., Mullite Refractories Co., Lancaster, Ohio.

CHESAPEAKE CHAPTER

Allan L. Tarr, Met., Engineering Research & Devel. Lab., Fort Belvoir, Va.

CHICAGO CHAPTER

William Kuyper, Salesman, Federated Metals Div., American Smelting & Refining Co., Whiting, Ind.
Victor W. Peterson, President, Bridgeman Castings, Inc., Chicago.
John H. Staiger, Met. Engr., Michiana Products Corp., Chicago.

DETROIT CHAPTER

Richard Allen Green, Sand Tech., Harry W. Dietert Co., Detroit.
Charles N. Tanton, Jr., College Grad. in Train., Cadillac Motor Car Div., G. M. C., Detroit.

METROPOLITAN CHAPTER

John Blackwood, Gen. Fmn., Singer Mfg. Co., Elizabeth, N. J.
C. H. Cline, Factory Repr., Master Pneumatic Tool Co., Inc., Roselle, N. J.
Alan Dean Kattelle, Special Appr., American Brake Shoe Co., New York.
Edith Wright, Librarian, Rutgers University, Brunswick, N. J.

MICHIANA CHAPTER

Alex J. Juroff, Fdy. Met., Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.
Anton A. Piller, Core Room Fmn., Oliver Corp., South Bend, Ind.

MO-KAN CHAPTER

Fred Canfield, Owner, Fred Canfield Foundry Sands, Kansas City, Kan.
Lloyd Canfield, Fred Canfield Foundry Sands, Kansas City, Kan.

NORTHEASTERN OHIO CHAPTER

Kenneth S. Brooker, Student, Case Institute of Technology, Cleveland.
Fire Brick Service & Supply Co., Cleveland, Ohio (L. A. Cutter, Pres.-Mgr.)
Joseph O. Danko, Jr., Supv. Trainee, Ferro Machine & Foundry, Inc., Cleveland.
Alfred C. Eastwood, Sls. Engr., The Tabor Mfg. Co., Philadelphia.
Bruce J. Ferencz, Asst. Fmn., Ferro Machine & Foundry, Inc., Cleveland.
Robert H. Herrmann, Asst. Editor, The Foundry, Cleveland.
Harry E. Leickly, Annealing Fmn., Fanner Mfg. Co., Cleveland.
Edward J. Pergler, Student, Case Institute of Technology, Cleveland.
Arnold L. Robertson, Shift Fmn., Aluminum Company of America, Newburch Hts., Ohio.
Donald S. Smith, Wellman Bronze & Aluminum Co., Cleveland.
Robert George Spinks, Student, Case Institute of Technology, Cleveland.
Hugh K. Stevenson, Sls. Engr., U. S. Hoffman Machinery Corp., Cleveland.

NO. ILLINOIS & SO. WISCONSIN CHAPTER

Herbert J. Hansen, Molding Fmn., Fairbanks Morse & Co., Beloit, Wis.

NORTHWESTERN PENNSYLVANIA CHAPTER

Oliver W. Griswold, Molder, General Electric Co., Erie, Pa.
C. P. Harrison, Partner, Harrison Machine Co., Wesleyville, Pa.
Duane G. Keep, Owner, K. & L. Refractory Service, Erie, Pa.

ONTARIO CHAPTER

Arthur J. Barnwell, Sand Tech. Canadian Westinghouse Co., Ltd., Hamilton, Ont., Canada.
John Reith, Canada Metal Co., Ltd., Toronto, Ont., Canada.

OREGON CHAPTER

Wm. F. Clark, Fmn., Modern Pattern Works, Portland.
C. V. Kile, Jr., Shop Fmn., Western Foundry, Portland.

PHILADELPHIA CHAPTER

Jay Giaccio, Sls. Engr., James Yocom & Son, Inc., Philadelphia.

QUAD CITY CHAPTER

Leo L. Bonderer, Salesman, Fire Brick Specialtie, Rock Island, Ill.

ST. LOUIS DIST. CHAPTER

Henry O. Steinmetz, Met., Liberty Foundry Co., St. Louis.

SOUTHERN CALIFORNIA CHAPTER

Frederick N. Menzel, Rich Manufacturing Co., Los Angeles.
J. Moffat, Jr., Refr. Slsmn., Gladding, McBean & Co., Los Angeles.
Linmold Company, Compton, Calif., (Linne Nelson, Part-Owner).

TENNESSEE CHAPTER

J. C. Short, U. S. Pipe & Foundry Co., Elmo, Tennessee.

TEXAS CHAPTER

H. C. Dill, Met., Staff Engr., Hughes Tool Co., Houston, Texas.
Charles T. Wilson, Fdy. Supt., Oil City Iron Works, Corsicana, Texas.

TIMBERLINE CHAPTER

Clarence A. De Vries, Sls. Engr., Carborundum Co., Denver.
Douglas W. Grobecker, Met. Engr., Los Alamos Scientific Lab., University of California, Los Alamos, N. M.

TOLEDO CHAPTER

Ralph W. White, Fdy. Supt., E. W. Bliss Co., Toledo, Ohio.

TWIN CITY CHAPTER

Bay City Sand Co., Bay City, Wis., (Arthur A. McHardy, Co-Owner & Co-Operator).
Viola J. McHardy, Co-Owner & Co-Operator, Bay City Sand Co., Bay City, Wis.
Frank Parsons, Slsmn., Koppers Co., St. Paul.

WESTERN NEW YORK CHAPTER

Duncan Cameron, Fdy. Fmn., Tonawanda Engineering Co., Tonawanda, N. Y.
Gerald F. Goetsch, Dist. Mgr., Sterling Wheelbarrow Co., Buffalo, N. Y.
George E. Tucker, Asst. Fmn., Tonawanda Engineering Co., Tonawanda, N. Y.

WISCONSIN CHAPTER

John W. Blakey, Jr., Partner, M. A. Blakey Co., Milwaukee.
Harry Kilbey, Pattn. Shop Fmn., Universal Foundry Co., Oshkosh, Wis.
Harry E. Ollenburg, Chief Insp., Pelton Steel Casting, Milwaukee.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Thomas Russell Eggert
Charles L. Register

MISSOURI SCHOOL OF MINES & METALLURGY

Robert W. Buel
Ralph E. Johnston

OHIO STATE UNIVERSITY

Lester C. Brinser
Leon R. David
John H. Eggleston
Robert A. Kubach
James D. Smith
Frank H. Stevens
John W. Wasem

OUTSIDE OF CHAPTER

Irving Berman, Met., Watertown Arsenal, Watertown, Mass.
Edward M. Broad, Met., Hitchiner Mfg. Co., Inc., Manchester, N. H.
Douglas R. Hayes, Met., Pratt & Whitney Aircraft, E. Hartford, Conn.
Dr. Yeh Chy-Pei, Economic Affairs Officer, Organization United Nations, Lake Success, N. Y.

INTERNATIONAL

England
West Yorkshire Foundries, York, England.
Finland
Carl Axel Robert Lindberg, Gne. & Tech. Mgr., Centralgjuteriet Ab., Helsinki, Finland.
Sweden
Sven H. Toresson, Fdy. Mgr., Gothenburg, Sweden.

Eight College Fellowships Sponsored By American Refractories Institute

REFRACTORIES RESEARCH FELLOWSHIPS, sponsored by the American Refractories Institute in the interest of furthering training of technologists for the refractories industry, have been established at seven universities having ceramics departments. The eight research fellows, chosen from worthy graduate students and appointed by the institute, are:

Richard L. Allen, Ohio State University, investigating influence of high forming pressures on porosity, density and strength of refractory compositions containing high percentages of course non-plastic materials.

Henry C. Brassfield, Missouri School of Mines and Metallurgy, studying behavior of titanium dioxide on silica brick during burning, as a catalyzer, to convert quartz to cristobalite and tridymite.

William E. Brown, Rutgers University, investigating part played by alkalies on refractoriness of siliceous fireclay brick.

William D. Fitzpatrick, University of Illinois, conducting an investigation on effects of glass phase present in certain refractory compositions.

J. Raymond Hensler, Pennsylvania State College, studying electrical resistance of refractories at elevated temperatures.

William D. Kingery, Massachusetts Institute of Technology, investigating certain orthophosphate cements for use in refractory compositions by studying the mechanics of setting, bonding properties and effect of heat on stability.

Robert A. Morgan, Pennsylvania State College, studying phase relations of the system beryllia-alumina-silica of interest to metallurgists.

Hugh H. Wilson, Jr., North Carolina State College, determining the hot-load-bearing characteristics of silica clay refractory compositions made from selected raw materials prepared with controlled grain sizes.

Powder Cutting Scrap Iron Wheels

SCRAPPING LARGE CAST IRON WHEELS has been accomplished successfully by means of powder cutting at the Bates Expanded Metal Co., East Chicago, Ind., where other cutting methods had proven unsuccessful.

Four cuts were made in each rim of large cast iron wheels, 10 ft, 6 in. in diameter and weighing about five tons each. Cuts were made at the thickest sections of the rims, the hub was split and the spokes were cut at the rim and hub. As the lowest wheel was in a well, it was necessary to rotate it as cuts were made. Time for cutting through the rim was about 12 minutes. An oxygen-cutting blowpile equipped with a powder adapter was used.

KIRK AND BLUM

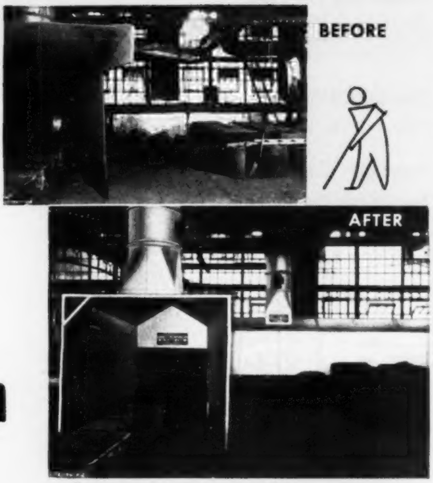
Plenum chamber hood "Cleans up" mold conveyor operation

American Foundry Company Replaces old Dust and Fume Removal System with modern KIRK & BLUM INSTALLATION

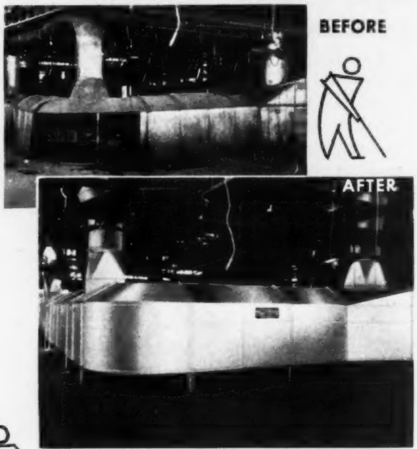
As a major step in foundry modernization and clean-up, the American Foundry Company of Indianapolis replaced their old, inefficient mold conveyor hood with a modern, efficient hood, designed and installed by KIRK & BLUM. The old system, as shown in the "before and after" photos, was severely worn; the air withdrawal rate was low, permitting dust and smoke to escape into the foundry.

The new KIRK & BLUM hood is designed so that the top is a plenum chamber, distributing air along the entire length of the hood. Every other panel is removable for access. Four exhaust units connect to the hood; each has a capacity of 13,000 CFM. Total air removed, 52,000 CFM, assures this firm cleanliness never before possible.

KIRK & BLUM systems, in many of the nation's leading foundries, practically eliminate dust and fumes from traditionally "dirty" jobs. Call the KIRK & BLUM Representative . . . more than 40 years of experience at your command, or ***write for your copy*** of "Dust Collecting Systems in Metal Industries," showing other typical installations. *The Kirk & Blum Mfg. Co., 2876 Spring Grove Ave., Cincinnati 25, O.*

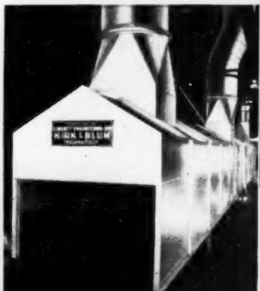


1. Entrance end of hood; note bolted section construction for ease of maintenance of conveyor.



2. Corner of conveyor. Note that new hood is off floor for ease of cleaning.

Designed, Fabricated and Installed by Liberty Engineering Div., KIRK & BLUM, Indianapolis, Ind.



3. Exit end of conveyor and hood, showing the four duct-mounted exhausters with total capacity of 52,000 CFM.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST AND FUME CONTROL SYSTEMS

Trademarks of Distinction

THESE and many other leading manufacturers in the farm equipment field protect their products with Tousey Casting Sealer. Tousey originated the manufacture of casting sealer to rigid specifications. Copies of these specifications, revised over the years to meet current needs, are available on request.

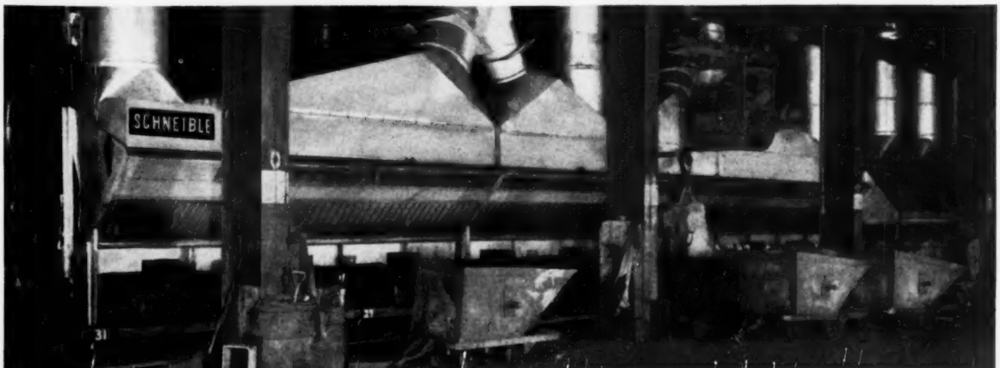
TOUSEY VARNISH CO., 520 W. 25th Street, Chicago 16, Ill.

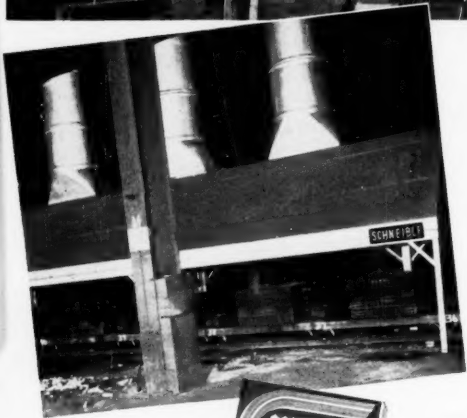
TOUSEY PRODUCTS
CASTING SEALER

Summer and Winter...

SCHNEIBLE COMPENSATING UNI-FLO HOODS

PROVIDE IDEAL POURING CONDITIONS



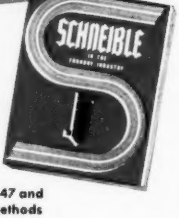


"Compensating Air" at the exhaust hood is the *latest Schneible improvement* in foundry ventilation for pouring operations. This principle provides cooler building temperatures in summer because the air supply is taken from high inside the foundry. This hot air is naturally replaced by cool air from outside. In cold weather the compensating air is taken from outside the building, thus conserving loss of warm inside air. This lowers power plant output, effecting fuel savings.

The ventilation is improved by directional control of the air. Contaminated area can be blanketed with clean air without directly striking the workmen.

The *Schneible Compensating Principle* can be applied also for shake-out operations, mold cooling conveyors and other applications where large volumes of air are exhausted.

Our engineers are trained to help you cut costs and provide greater efficiency through better dust and fume control. (U.S. and Foreign Patents applied for.)



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Write for Bulletins Nos. 410, 47 and 88 which cover Schneible methods of ventilation and dust control.

MULTI-WASH COLLECTORS

Two models are available: the HC with capacities from 1500 to 30,000 c.f.m. or multiple units for larger capacities.

The JC—from 1000 to 30,000 c.f.m. capacity or in multiple units.

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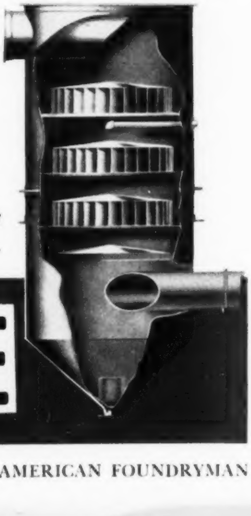


SCHNEIBLE

KEOKUK-WENATCHEE NOW ONE!

THE TOWN PRATTLER COLUMN

by Chief Running-at-the-Mouth

Chief Keokuk, the Indian Country's most eligible bachelor, has at last captured the heart and hand of the Redmen's favorite pin-up princess, the Wenatchee herself. Keokuk, mighty hunter, fearsome warrior, utterer of great metallurgical truths and his charming bride are shown in the informal candid photograph above. The couple is even now off on a honeymoon trip by covered wagon. The Chief claims his bride can average a five-mile-an-hour speed at the yoke if her new moccasins don't pinch her feet.

Chittum-Chattum on Keokuk Wenatchee Wedding: While the Big Chief and his lovely Princess were double-trailing it, the Keokuk Electro-Metals Company of Keokuk, Iowa, proudly established a new plant at Wenatchee, Washington. Wigwam news sources, known to be reliable, tell your copperskinned correspondent that the new division plant will begin at once manufacture of the famous ELECTRO-SILVERY pigs and piglets there in the heart of the Northwest's power-rich Inland Empire.

A late news flash on our private *tom-tom ticker* confirms the good word that these new facilities will practically double Keokuk's electro-silvery output and will permit stockpiling for improved shipping services throughout the West and Midwest.

Wenatchee, which the paleface translates as "Foot of the Rainbow," will now shoot out those silvery pigs and piglets from the shores of the Columbia River apple country while the Keokuk plant at the other end of the rainbow will continue shooting out an expanding silvery stream into the midwest and south. On the way to their ermine-trimmed nuptial wigwam the bridal couple was overheard to remark (and this is exclusive), "Heap big pile of pigs! Ugh!" (For paleface readers "Ugh" is translated "WOW!")

60-lb. pigs for steel plants

30-lb. pigs and 12½-lb. piglets for foundries.

KEOKUK electro-silvery

BY KEOKUK ELECTRO-METALS COMPANY
KEOKUK, IOWA

WENATCHEE DIVISION, WENATCHEE, WASHINGTON

SALES AGENTS: MILLER AND COMPANY, 332 S. Michigan Avenue, Chicago 4, Illinois. Cincinnati 2, Ohio, 3504 Carew Tower · St. Louis 1, Mo., 407 N. Eighth St.

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Refractory Materials

AP101—A comprehensive, combined bulletin, covering a wide range of refractory castables, plastics and mortars is announced by the Babcock & Wilcox Co. Many of the products described are suitable for temperatures as high as 3000F and one, Kromecast, for as high as 3100F. Illustrated with many photographs and tables of properties and required quantities, this 18-page bulletin is designed for the use of builders and operators of all types of industrial furnaces. The booklet contains a complete section on refractory castables, including new high-temperature materials designed to reduce cost of furnace construction and maintenance. Included are detailed notes on the application of each product and an analysis of properties of B&W refractory castables. Data is also given on refractory plastics, what they are and when they should be used. Refractory mortars are thoroughly reviewed and their properties, characteristics and applications are presented, together with a convenient chart for selecting and ordering material suitable to individual requirements.

Surfacers and Grinders

AP102—*"Surfacers and Grinders"*, a six page bulletin issued recently by Buehler, Ltd., describes new Buehler developments in this field. Applications, specifications, general information and prices are given for the Nos. 1211 and 1212 Wet Power Grinders, No. 1214B Diamond Dresser, a Recirculating Cooling System, No. 1250 Belt Surfacer, No. 1200 Bench Grinder, and No. 1251 Duo-Belt Wet Surfacer. Also described are other items in the Buehler line of equipment for the laboratory.

Products Review

AP103—The 1948 Annual Review of the Allis-Chalmers Mfg. Co., 40 profusely-illustrated pages showing the company's developments during the past year, is now available free-of-charge to readers of AMERICAN FOUNDRYMAN.

Universal Tester

AP104—Bulletin M issued by W. C. Dillon & Co., Inc., describes the Dillon Universal Tester and its specifications.

Rough Grinding

AP105—A 48-page, illustrated booklet, issued recently by the Norton Co., gives background information about abrasives and bonds. Written specifically for foundries and allied metallurgical industries, *"Rough Grinding"* is the result of several years' research on the part of Norton engineers. Each type of grinding, such as swing frame, floorstand, portable, disc and weld, is covered by a separate section and several full pages are devoted to wheel specifications. In addition, there are sections on mounted wheels and mounted points, cut-off wheels, core files and rubbing blocks, plus information regarding wheel evaluation and grinding costs for accurate computation.

Battery Technology

AP106—A major technical contribution to battery purchasers, users and maintenance men is Gould Storage Battery Co.'s new, free 40-page, pocket-size handbook of instructions and engineering data on the care of motive-power batteries. The handbook is divided into four sections: Care and Operation, Maintenance and Repairs; Parts; and Technical Data. It is prefaced by two double-paged spreads giving exploded views of the tape-insulated and mat-insulated types of batteries. Each part of the battery is clearly shown in relation to the others and is keyed to descriptive text. Available free-of-charge.

Floor Chain Conveyor

AP107—A four-page folder issued by Jervis B. Webb Co. describes the Towveyor, a chain conveyor running below the floor which engages vertical pins on ordinary shop trucks to move them about on a circuit.

Alloy Selector

AP108—Foundrymen, engineers and manufacturers incorporating aluminum alloys into their products will find the United States Reduction Co.'s USCO Alloy Selector a handy aid. The Selector, a modified slide rule containing a movable center chart, shows at a glance the typical as cast, stabilized and heat treated mechanical properties of the 23 most popular aluminum sand, permold and die cast alloys. Chemical specifications and available shapes are listed in a compact table for the convenience of deoxidation alloy users. Available gratis.

Foundry Engineering Service

AP109—"Facts About a Specialized Service for Foundries" is the title of an illustrated brochure recently released by Engineering Service, Inc. The brochure describes the orgańization's work methods—analysis of present foundry methods and equipment, compilation of data and preparation of findings and recommendations, complete plans and specifications for recommeded changes and complete project responsibility. Sample engineering diagrams prepared for foundry customers are given as is a list of users.

Hydraulic System Solvent

AP110—Swan-Finch Oil Corp.'s new bulletin describes Hydro-Solv "A", a new product for removing gum, sludge, and other efficiency-reducing contaminants from hydraulic systems. Recommended for use when hydraulic systems "act up," particularly during crucial production periods, Hydro-Solve "A" is left in the system for 100-150 working hours, and dissolves all contaminants for removal when the system is drained. Also recommended for cleaning gear units.

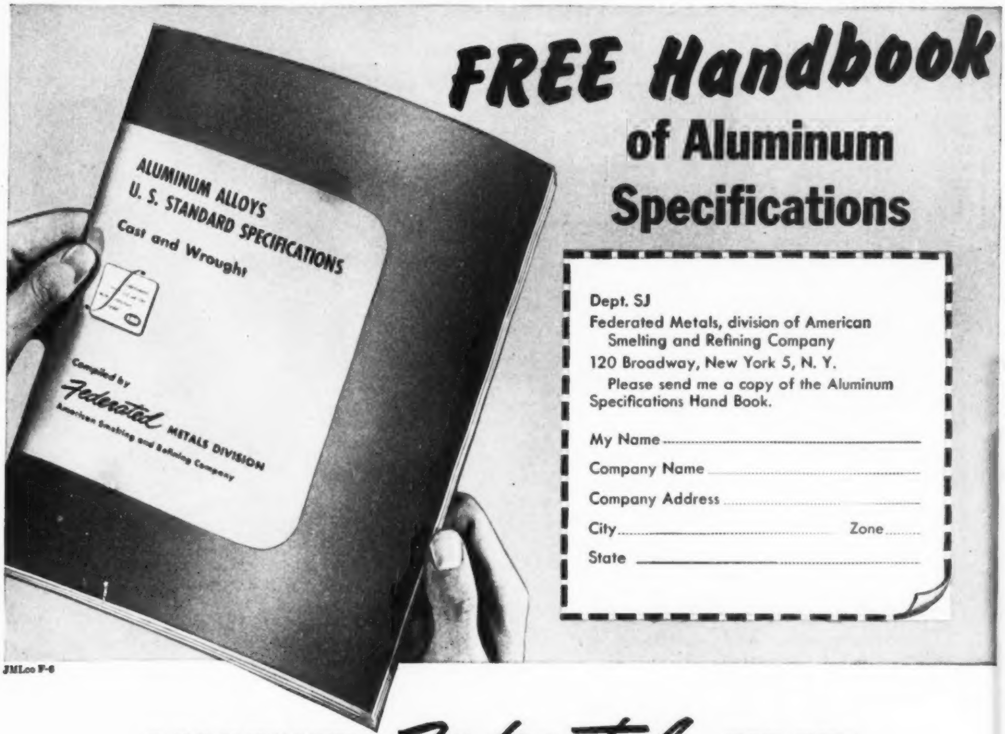
Transformer Care

AP111—A 16-page booklet on the care and operation of dry type transformers has been issued by the Allis-Chalmers Mfg. Co. and covers instructions for unloading the transformer and suggestions for its installation or storage. A number of approved methods of drying coil and core assemblies are given should the transformer become exposed to moisture at any time. The manner of placing the transformer in service, and maintenance hints are contained in the booklet, together with a description of accessories and equipment and typical wiring diagrams for thermal control equipment. Six available terminations and high-voltage switch arrangements are shown. The booklet also carries switch plate information and a description of induced cooling.

Measuring Instruments

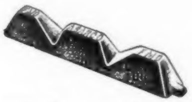
AP112—Temperature and air velocity measuring instruments designed to with-

(Continued on Page 184)



JMLco F-6

ANOTHER *Federated* FIRST!



For your convenience . . . here in one 24-page volume . . . are all the latest specifications of the aluminum industry—ASTM. AMS, SAE, Federal, Army, Navy and others—as they pertain to Sand Castings, Permanent Mold Castings, Die Castings, Wrought Alloys and Ingots.

This 24-page book is *not* a sales manual. There is no talk in it about the nationwide production, research, and service facilities of Federated which make this company first in the non-ferrous field . . . no facts which prove that Federated's scientific production control and friendly, on-the-spot help with foundry problems mean more satisfactory and profitable products for *you*.

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DELTA PRODUCTS for the FOUNDRY are PRODUCTS OF RESEARCH

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Every DELTA Foundry Product was first tested by laboratory methods and then submitted for use and final approval in ACTUAL FOUNDRY PRACTICE before it was identified with the name "DELTA".

From basic raw materials to the finished product every step in the manufacture of DELTA FOUNDRY PRODUCTS is under strict laboratory control in order to maintain absolute uniformity and rigidly protect quality standards.

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CORE AND MOLD WASHES:

FOR STEEL:

Delta Special Core & Mold Wash Base — Used by more steel foundries than all other types of washes combined.

Delta SteelKoat, a finished high fusion waterproof wash.

FOR ALL TYPES OF SAND CAST METALS:

Delta ThermoKoat — It's plasti-lastic, non-heat shocking, highest fusion and hot strength.

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Delta BlacKoat S-5, a new and different wash. Produces results, on gray iron castings unequalled by any other wash.

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Delta NonferrusKoat, produces unusually smooth surface castings.

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Delta Partex (Nutshell partings) has lycopodium properties, non-injurious and non-hazardous to use.

Delta Liquid Parting — Low cost, highly effective and lasting.

Delta Sand Conditioning Oil — Sticking core sand mixes work freely in core boxes when sand conditioning oil is added to core sand mixes.

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Delta Sliktite — A light colored mud for all types of metal castings.

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For Steel and Gray Iron — Use Delta Bondite, a dry binder which becomes waterproof on drying and produces mold atmosphere which is high in reducing gas.

CORE ROD DIP OIL NO. 224X TIES CORE RODS AND WIRES INTO THE CORES:

Rods and wires coated with Delta Core Rod Dip Oil adhere to the sand. Eliminates need for 50% of the rods and wires and reduces core breakage.

CORE OILS:

High tensile, low gas, faster baking, exceptionally economical to use.

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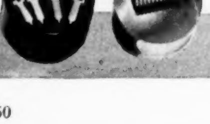

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CHAPTER ACTIVITIES

(Continued from Page 148)

Indianapolis, to hear V. J. Sedlon, Master Pattern Co., Cleveland, speak to the Chapter on *"Modern Pattern Equipment"*.

Mr. Sedlon's talk was illustrated with a series of projector slides and was followed by a question and answer period which attracted great interest. The speaker was introduced by Leo Rice, International Harvester Co., Indianapolis Works, who served as technical chairman for the meeting.

The meeting was preceded by a directors business meeting at which Robert Langenkamp, chapter chairman, announced the appointment of Jack W. Giddens, foundry metallurgist, International Harvester Co., Indianapolis, as vice chairman to fill the unexpired term of Howard Creps, formerly of Frank Foundries Corp., Muncie, Ind., who recently resigned.

Western New York

Roger E. Walsh
Hickman, Williams & Co., Inc.
Chapter Secretary

THE FEBRUARY MEETING featured an address by William M. Ball, Jr., R. Lavin & Sons, Inc., Chicago, on *"The Effective Essentials in Making a Casting"*.

The first things to think of in the foundry, according to Mr. Ball, are materials, machines and men. Other essentials are metal behavior patterns, melting points, sand penetration, castings uses, number of castings required and length of time needed to make them.

Truths are essential to survival, the speaker concluded, and if the founder does not understand basic scientific truths, he is punished for it. Mr. Ball cited good supervisory training and initiative as primary requisites of good castings production.

The speaker at the March meeting was B. P. Mulcahy, who spoke on *"Present Day Coke and Its Use in the Foundry"*.

Good cupola operation depends upon the quantity and quality of the materials that go into the cupola, Mr. Mulcahy said.

Today's cost of building ovens to produce coke cannot be justified, the speaker said, and consequently

the supply of good foundry coke is limited. Mr. Mulcahy added that as a means of doing the best possible work with the materials at hand, it pays to remove every other tine in the coke fork to eliminate the smaller size coke when preparing it for the charge.

Mr. Mulcahy followed his talk with slides showing the manufacture of coke and the effects of small coke in the cupola.

Cincinnati District
B. A. Genthe
S. Obermeyer Co.
Chapter Reporter

THE FEBRUARY MEETING, held at the Engineering Society, February 14, featured an address by B. D. Claffey, Acme Aluminum Alloys, Inc., on *"Foundry Education"*.

Mr. Claffey said that the foundry offers industry's greatest challenge to the youth of today.

The first step, he said, is to show educators the opportunities that exist in the foundry, in order that they may give vocational guidance to the students. Industry-educational relations should be handled by competent men from the industry, who are capable of creating interest in the foundry on the part of students and educators.

Mr. Claffey urged that technical men avail themselves of every opportunity to speak before gatherings of students, in order to create interest in the foundry and in the establishment of foundry trade school courses.

Western Michigan
S. H. Davis
Campbell, Wyant & Cannon Foundry Co.
Chapter Secretary

"CONVEYER BELTING" was the topic of a discussion led by T. B. Walker and Paul Quinn, Goodyear Tire & Rubber Co., at the February meeting. Messrs. Walker and Quinn also showed two films in conjunction with the discussion, *"The Way Over the Mountain"* and *"The Way Out."*

Central New York
John A. Feola
Crouse-Hinds Co.
Publicity Chairman

THE MARCH MEETING featured Ralph L. Lee, General Motors Corp., as principal speaker. Some 70 members and guests attended the meeting, held at the Onondaga

Prompt shipment—unlimited quantities now available to foundries from BAROID—the world's largest producer of Bentonite. Our modern plants are geared to fulfill every requirement of the foundry trade.

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Raising prices builds up sales resistance. Make your profits by economies in the foundry.

Avoid heavy capital investments by installing Crucible Furnaces. The lowest installation cost, the surest satisfaction, and the most economical service is found only in Crucible Furnaces. Every way you take it Crucible Furnaces mean most for your money.

Our advice is before (not after) you decide on your non-ferrous melting equipment, consult a Crucible furnace manufacturer. Ask for Crucible Melters' Handbook—a handy little volume that should be in the hands of every melter.

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Hotel, Syracuse. Mr. Lee, in speaking on "*Human Relations*", pointed out that managers and other supervisory personnel must treat each worker as an individual.

The speaker's portrayal of the many types of personalities found in a group of employees further emphasized the need for understanding them. Mr. Lee also pointed out that it was a challenge for anyone to attempt to co-ordinate these different personalities into a contented, harmonious group.

In his closing remarks, Mr. Lee said if more "humanics", as he termed it, were used in industry there would probably be much less trouble between industry's workers and management.

During the social hour following his talk, Mr. Lee entertained the group with a description of his own little one-man foundry which has been a hobby for many years.

Central Michigan

A. J. Stone
Albion Malleable Iron Co.
Chapter Reporter

The February meeting featured as its speaker Leonard F. Tucker, City Pattern & Foundry Co., South Bend, Ind., vice-chairman of the A.F.S. Pattern Division, who spoke on *"Cooperation Between the Foundry and Pattern Shop"*.

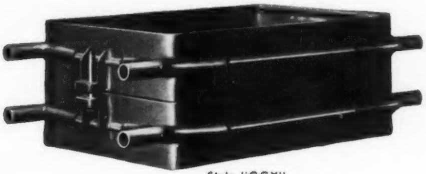
Mr. Leonard stated that the pattern is the most important tool of the foundry, since the economic factor of cost is dependent upon the moldability and adaptability of the type of pattern equipment used. He traced the history of pattern equipment from the loose piece to the pattern engineer. He emphasized the fact that cooperation between the pattern shop and foundry is more necessary in smaller industry since they cannot meet the cost of a pattern engineer.

In making pattern equipment, he explained the importance of consulting the customer on the important items of draft, parting line and allowance for contraction. He also discussed the importance of correct core boxes, dryers and problems incurred by incorrect and incomplete equipment of this type. He concluded his talk by stating that if the foundryman buys pattern equipment, he must be as specific as possible to assure receiving what he

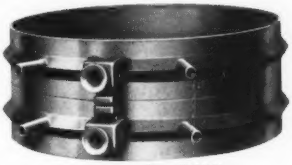
(Continued on Page 168)

THE DEPENDABLE *Sterling* LINE OF STEEL FOUNDRY FLASKS

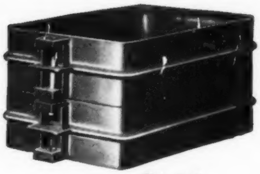
North American foundries . . . more than 4,000 of them . . . have adopted Sterling Steel Flasks for greater efficiency, longer life and more profitable foundry operation. These same foundries continue to specify Sterlings whenever more flasks are needed. That's because Sterlings have the strength and rigidity to resist distortion and to take hard, everyday punishment. Fabricated from special rolled steel channel into one solid, rigid piece, Sterling Flasks are capable of withstanding tremendous pressures. They retain their rigidity and accuracy over a long period of years. Available in a variety of styles and shapes. Write for your copy of Sterling Catalog No. 59.



Style "GGX"
with Single Pin Lugs and
Two-Man Lift Handles



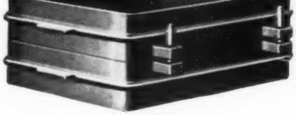
Style "BBLT"
with Trunnions and
Two-Man Lift Handles



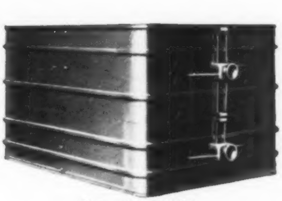
Style "A"
with Double Pin Lugs

Style "A"
Flask Sections
Stacked One Above Another
for Multiple Molding

Style "S"
with Pin Lugs and
Handles Combined



Style "H"
with Pin Lugs
Welded on Sides



Style "3/8 NT-NNT"
Heavy Duty Flask
(Patent No. 1974292)

Style "LL"
with Angle Reinforcement
and Two-Man Lift Handles

Style "3/8 NT-NNT"
with Heavy Duty Clamps
and Clamping Bars
(Patent No. 1974292)

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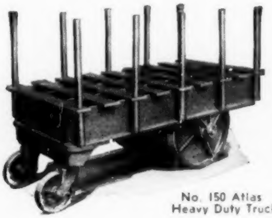
In addition to Steel Flasks, Sterling offers a complete line of Flask accessories and a variety of foundry equipment. Custom-built for heavy duty foundry service and high-speed production schedules, every piece of equipment is backed by the well-known Sterling reputation for correct design and excellent workmanship. The Company has always maintained a policy of fabricating to high quality standards. Consult Sterling the next time you require foundry equipment. The Sterling branch office near you will gladly give you information and estimates — or write to factory.

Heavy Duty Cart with "3-Point" Landing

No. 116-A Heavy Duty Wheelbarrow

No. 50 Slag Buggy

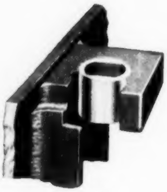
No. 110-A Core Truck



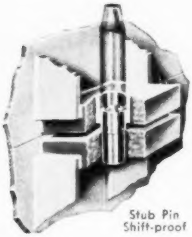
No. 150 Atlas Heavy Duty Truck

No. 160 Heavy Duty Casting Truck

Sterling Flask Clamp

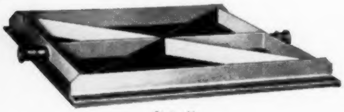


Standard Hardened Steel Bushing



Stub Pin Shift-proof

Caster with Pneumatic Tire



Style X Bottom Board with Trunnions

Style X Core Plate

Standard Type "S" Flask Pin

No. 47 Casting Cart

Hardwood Foundry Wedges

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Branch Offices: Boston • Buffalo • Chattanooga • Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis

CHAPTER ACTIVITIES

(Continued from Page 162)

desires at the smallest expenditure.

The talk was followed by slides illustrating the different problems and phases of producing the equipment in conjunction with a very spirited round table discussion.

Fitz Coghlin, Albion Malleable Iron Company, acted as technical chairman and C. C. Sigerfoos, Michigan State College, presided.

Michiana

S. F. Krzeszewski
American Wheelabrator & Equip. Corp.
Publicity Chairman

The February meeting, held at the La Salle Hotel, South Bend, Ind., February 1, was attend by 114 members, who heard H. L. Campbell, Scientific Products Co., speak on *"Cores and Core Materials."*

Having spent some 30 years in research work in this field, Dr. Campbell shared with his audience many of his experiences and revealed proper and improper practices of producing cores.

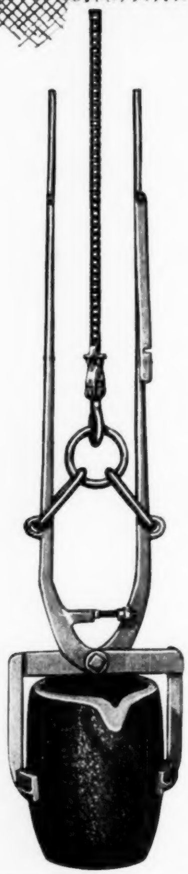
Choosing seven basic rules for good core practice, Dr. Campbell explained in detail the operation of each rule. The seven fundamentals are:

1. Select core sands on the basis of grain distribution.
2. Select core binders on the basis of properties required.
3. Establish standard economical mixtures based on actual properties.
4. Determine best procedure for mixing based on results obtained.
5. Adjust baking conditions to obtain most favorable properties.
6. Check properties of standard core sand mixtures regularly.
7. Arrange to have all dry sand cores placed in green sand molds for the shortest time before pouring.

In the evaluation of properties of core mixtures, Dr. Campbell presented various mixtures, showing requirements of binders, baking temperatures, green strength, dry strength, gases evolved and temperature ranges within which sand binders are effective.

There are many core blowers on the market, but the basic principles of all of them are the same. Some of the increases in core production with the use of blowers have been phenomenal, however, with improper rigging, the box may be

New Cradle Type
CRUCIBLE TONGS



Here is the latest advance in tong engineering.

One glance at the illustration shows how simple the Industrial design actually is. And not only is it simple, it's *adjustable*. Turn the adjustment screw when necessary to compensate for wear and the four pads on the cross-arm or claws engage the pot firmly for lifting or carrying.

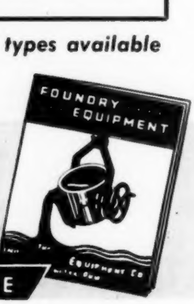
You will notice that this design is not complicated. It's simple, it's safe, yet it does everything you expect of a tong.

Notice also the Industrial design carries the crucible in the same manner as in the pouring shank. There is no crushing or pinching of the sidewalls. Eliminated are cracked pots from this cause.

Industrial furnishes this tong for all makes and sizes of crucibles. Write for details today.

- LIGHT WEIGHT
- ADJUSTABLE
- LESS EXPENSIVE
- EXTENDS CRUCIBLE LIFE
- POSITIVE, SAFE CONTROL

All standard types available



Industrial
EQUIPMENT COMPANY
115 N. OHIO ST. MINSTER 2, OHIO
LATEST CATALOG AVAILABLE

ruined, or the increases may not be what they should.

The material that goes into the core box is more important for blowing than for any other type of coremaking. It should be light and tough so as to be easy to handle and withstand the abrasive action of the sand. The joints must be tight to eliminate any air leaks and subsequent sand leaks. The ribbing on the back sides should be so placed to give the greatest support and the tightest fit around the box cavity.

The proper location of blow holes and sufficient vents are important in lengthening the usable life of a core box. Proper maintenance of the boxes as well as the blowers themselves has been proven to be good economy.

F. W. Shipley, Chapter Chairman, appointed the following men to the nominating committee to select the officers for the coming year: A. V. Martens, L. E. Roby and C. R. Russell.

Metropolitan
George Baer
Atlas Foundry Company
Publicity Chairman

"Cupola Operation" was the subject of the lecture given by L. L. Clark, assistant foundry metallurgist of the Buick Motor Company, Flint, Mich., on February 7 at the Essex House, Newark, N. J.

After being introduced to the group by John Van Haver of Worthington Pump and Machinery Corporation, Harrison, N. J., Mr. Clark presented a description of the practice followed in the highly mechanized gray iron foundry of the Buick Motor Co., accompanied by slides illustrating the installations and various phases of the operations.

Throughout his discussion, Mr. Clark stressed the fact that control in the foundry industry is often behind the times, sometimes to the point that advances in other methods of manufacturing often bring about the replacement of castings for parts which have been traditionally made in the foundry by other types of units such as forgings or weldments.

This retarding of the foundry industry can be overcome by three principal means. First, foundries should exert more pressure on machinery manufacturers to make

more rapid advancements in keeping up with the times.

Second, it is important for management to realize the multitude of problems encountered in the foundries and to encourage means of coping with them. It is important that management be open to suggestions for changes both in practice and in equipment for improving quality and efficiency.

Third, foundry personnel should overcome their traditional backwardness towards new ideas.

Mr. Clark emphasized the stress placed on looking for new methods at Buick, both in production and laboratory control. They are at present interested in the possibilities of routine instantaneous gas analysis and spectographic slag analysis for obtaining advance information on conditions of the metal in the cupola in order to exercise closer control over its quality throughout the operation.

Mr. Clark's talk was followed by a lively question period, during which he expanded on various points of his lecture and answered many additional questions brought up by the members.

Ohio State University
A. E. Stoner
Chapter Secretary

The February meeting, held February 8 at the Industrial Engineering Bldg. on the Ohio State campus, featured as its speaker Lester M. Merritt of the Division of Safety and Hygiene, Industrial Commission of Ohio, who spoke on "*The Silicosis Problem in Ohio Foundries*". Mr. Merritt told how consideration of occupational diseases was introduced into the Ohio Workmen's Compensation Law, and told of the provisions of the Occupational Disease Law that apply to silicosis.

Silica, Mr. Merritt said can be eliminated by the substitution of non-silica partings for tripoli. Harmful dusts can be reduced by eliminating silica flour from facings and washes. Dust can be confined by handling and storing dusty sands in enclosed elevators, conveyors and bins. Dust can be removed at the source by exhausting the shake-out, core knockout booths and grinding. Good housekeeping is an important overall factor in reducing dust.

Seven new members of the Ohio State University Student Chapter are: Lester Brinser, Leon David, John Eggleston, Robert Kuback, James Smith, Frank Stevens and John Wasem.

Massachusetts Institute of Technology
Richard A. Poirier
Acting Technical Secretary

Election of 1949-50 officers and an address by S. C. Massari, A.F.S. Technical Director were highlights of the February 23 meeting, held at the M.I.T. Foundry Laboratory.

Student Chapter officers elected for the 1949-50 school term are: *President*, Roland L. Ruetz; *vice-president*, Thomas J. McLeer; *secretary-treasurer*, Robert N. Randall; and *technical secretary*, Richard A. Poirier.

Speaking on "*Functions of A.F.S. and Its Relation to Industry and Graduates*", Mr. Massari divided his topic into three parts—(1) a brief history of the foundry industry (2) functions and aims of A.F.S., and (3) problems confronting the foundry industry.

Mr. Massari stated that the foundry industry as a whole is attempting to replace the "skilled thumb" with sound engineering practices. In times of depression, the foundry industry will not be as hard hit as others, because it forms a basic component of all industry, the speaker said.

Mr. Massari stated that A.F.S. offers foundrymen an opportunity to advertise their qualities by presenting technical papers.

A few of the major problems confronting foundrymen, engineers and salesmen are control of dimensions, sales engineering and testing

Over the years Ottawa's two outstanding brands —FLINT SHOT and DIAMOND SAND BLAST—have stood the test of time. Today usage of these high quality mineral abrasives is at an all-time high— in tonnage—number of users. Let us help you improve the quality and quantity of your sand blasting operation. Consult us on your abrasive problems.

Write for our booklet—SAND BLASTING UP-TO-DATE

OTTAWA SILICA COMPANY
Ottawa, Illinois

methods, and one of the most important problems is the lack of cooperation between the designer and producer of castings.

The meeting closed with a discussion period on the advantages and disadvantages of test bars.

St. Louis District
Paul C. Schwarz
Binkley Mfg. Co.
Publicity Director

A TIMELY WARNING to users of western bentonite was given at the February 10 meeting by T. E. Barlow, Eastern Clay Products Co., who said that the recent severe winter in the Western states has reduced output of western bentonite to a mere trickle. It will require 60 to 90 days for the bentonite producers to catch up with demand even if full railroad car requirements can be met at once, he said.

The speaker then cited alternative materials and processes open to foundrymen, and stated the precautions to be taken in their use.

Tri-State
F. E. Fogg
Acme Foundry & Machine Co.
Chapter Reporter

MEMBERS FROM THREE STATES and several guests attended the February 18 meeting, held in Tulsa, Okla.

F. W. Burgdorfer, Missouri Pattern Works, Inc., St. Louis, discussed "Plastic Patterns", their applications and methods of producing plates, boxes, etc.

The speaker offered for inspection several used patterns and boxes, citing the strength of the material and its ease of repair. Mr. Burgdorfer broke one pattern and repaired it during the meeting.

Central Illinois
V. W. Swango
Caterpillar Tractor Co.
Secretary-Treasurer

THE FEBRUARY MEETING of the Central Illinois Chapter was held at the Jefferson Hotel, Peoria, Ill., on February 7. The talk of the evening was presented by Carl F. Joseph, technical director of the Central Foundry Division, General Motors Corp. on *"Control of Materials and Operations in a Malleable Foundry"*.

In his opening remarks, Mr. Joseph stressed the importance of high quality castings being the cheapest for the foundry to produce. The

shortage of pig iron as well as good scrap for melting has definitely increased the foundry problems. He favored cupola air furnaces in conjunction with electrical furnaces for the best all around results. The mechanical controls for the melting of metals should be adequate and so placed that they can be operated from the area in front of the furnaces. The mechanical charging arrangements should be governed by the requirements of the shop as well as the type of materials being charged. It is possible to have the charging arrangements over mechanized; however, this is seldom the case, Mr. Joseph said.

Mr. Joseph presented a very interesting movie on improvements in methods of work in Central Foundry Division shops by time and motion study, showing how production can be increased with less effort on the part of the operator.

The entire group was entertained preceding Mr. Joseph's talk, by C. E. Jacobsen, President of Jacobsen and Daw, Inc., with an informal talk on *"Miscellaneous Conversation"*.

Harry J. Jacobson, Industrial Pattern Works, Chicago, presented a talk on *"Core Box Design and Rigging for Core Blowing"*, March 7th at the Jefferson Hotel, Peoria.

He opened his remarks by referring to core blowing as the most important development in the foundry industry in the past several years. It enables the industry to keep up with other methods of manufacture and it can lead to automatic operations in the foundry. Today we find the foundry on the threshold of the machine and tool age, Mr. Jacobson said. The core blower is the machine and core box the tool, and as is the rule in all tool design, the entire tool should wear out at the same time.

Eastern New York
John M. Jones
American Locomotive Co.
Publicity Chairman

THE FIRST NON-FERROUS ADDRESS of the year was given by B. A. Miller, Baldwin Locomotive Co., on February 15 at the Circle Inn, Lathams Corners.

Mr. Miller's talk was followed by questions and answers. First from the non-ferrous founders, and second from ferrous founders.

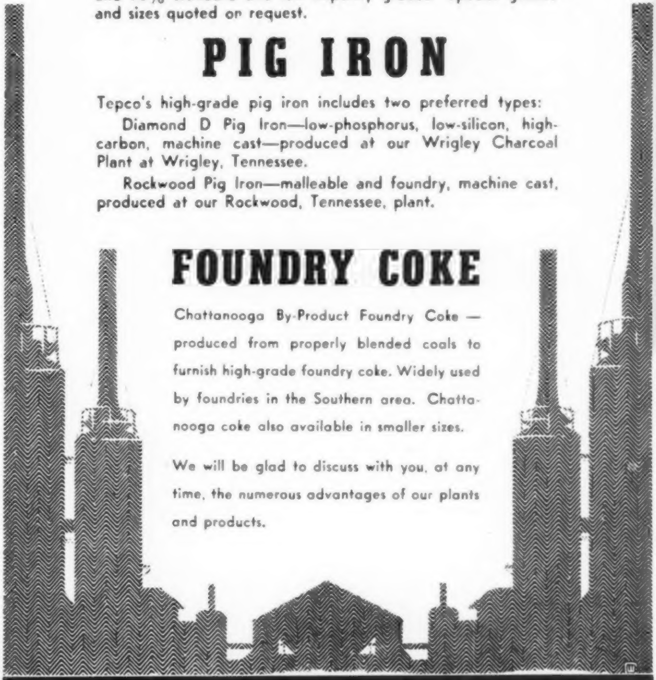
TEPCO

FERRO-SILICON BRIQUETTES

Tepco Ferro-Silicon Briquettes, used mainly for the addition of silicon to the cupola charge of iron foundries, are most convenient because they contain a certain definite weight and can be counted instead of weighed. At the same time, the briquettes are more valuable than lump ferro-silicon because the binder in the briquettes protects the ferro-silicon as it is melted in the cupola and a greater return of silicon is obtained by that means.

Tepco Ferro-Silicon Briquettes are produced at our Chattanooga plant (formerly Southern Ferro-Alloys Company, Chattanooga, Tennessee). The 2½-pound briquettes contain one pound of silicon and the 5-pound briquettes contain two pounds of silicon.

Tepco Ferro-Silicon is also available in all sizes from lump through 150 mesh by down, packaged or in bulk—50%, 65%, and 75% standard and low impurity grades. Special grades and sizes quoted on request.



PIG IRON

Tepco's high-grade pig iron includes two preferred types:

Diamond D Pig Iron—low-phosphorus, low-silicon, high-carbon, machine cast—produced at our Wrigley Charcoal Plant at Wrigley, Tennessee.

Rockwood Pig Iron—malleable and foundry, machine cast, produced at our Rockwood, Tennessee, plant.

FOUNDRY COKE

Chattanooga By-Product Foundry Coke — produced from properly blended coals to furnish high-grade foundry coke. Widely used by foundries in the Southern area. Chattanooga coke also available in smaller sizes.

We will be glad to discuss with you, at any time, the numerous advantages of our plants and products.

TENNESSEE PRODUCTS & CHEMICAL CORPORATION
GENERAL OFFICES: NASHVILLE, TENNESSEE
PLANTS AT CHATTANOOGA, ROCKWOOD AND WRIGLEY, TENN.
Represented by
MILLER & CO., Chicago, St. Louis, Cincinnati; S. H. BELL CO., Pittsburgh; T. H. BENNERS & CO., Birmingham
ORE & FERRO CORPORATION, 30 Broad St., New York, Export Agents

FOUNDRY FIRM Facts

Eastman Foundry recently began operations in its new 35 x 90 ft. plant at Conrad, Ia. Owner is M. N. Eastman, formerly of the Hawkeye Foundry, Waterloo, Ia. The new firm does original designing and makes gray iron castings and plans to do aluminum and brass castings later.

Vonnegut Moulder Corp., Indianapolis, recently sold its Woodworking Machine Division, which made the Vonnegut Electric Moulder, to **G. M. Diehl Machine Works**, Inc., Wabash, Ind. The sale of the Woodworking Machine Division will permit the Vonnegut organization to give more space and effort to its production of the Marschke line of grinders and buffers.

Electric Smelting Co., San Francisco, has moved to a new address at 1275 Indiana St. in that city.

L. W. & W. K. Mitchell, Indianapolis general foundry supply firm, has opened a new office and warehouse at 38 S. Shelby St. in that city. Increased warehouse space and a more central location have been provided for by this move. The firm was previously located at 3820 N. Capitol Ave., Indianapolis.

Davidson Industrial Contracting Co. Brooklyn, N. Y., has been named service representative for Raymond L. Smith Associates, distributors of Skylift electrical industrial trucks produced by the Automatic Transportation Co.

S. Cheney & Son Foundry, Manlius, N. Y. recently suffered a $50,000 loss as fire destroyed its cleaning room.

Universal Gear Corp., Indianapolis, recently installed a Hammond electric organ in the center of its manufacturing plant. The organ is played for the benefit of employees during working hours.

Tousey Varnish Co. recently completed installation and construction of ten new 10,000-gallon underground storage tanks on its factory grounds at 520 West 25th St., Chicago. The new tanks double existing storage capacity and will be used primarily for storage of raw materials, and are controlled by a pump house which feeds materials to six outlets in the plant.

The Trabon Co. a new firm located at 122 S. Michigan Ave., Chicago, will operate as manufacturers' representative serving the foundry industry. The company was formed by N. L. Mooneyham and John C. Lunkas, formerly general sales manager and director of purchases, respectively, for the Velsicol Corp.

C. E. Gobeil Co., St. Paul, Minn., has been appointed exclusive representative for Hydro-Line air and hydraulic cylinders and special machinery in the states of Minnesota, North and South Dakota, and part of Wisconsin.

Harry W. Dietert Co., Detroit, is sponsoring a Sand Testing School, consisting of a three-day session, whose object is to teach the technique and theory of sand control as it relates to casting quality and quantity. Films and slides are used to illustrate the newer developments in sand control, and the company's laboratories are available for actual test work. There is no charge for the course and students are invited to bring in casting defects for discussion. Usually one session is being held each month.

Allis-Chalmers Mfg. Corp., Milwaukee, on February 24 purchased the last War Assets Administration property to be disposed of in Wisconsin, a warehouse located six miles south of Milwaukee on Lake Michigan, for $300,000. The property will later be used for manufacturing purposes.

Whiting Corp.'s 116 Quarter-Century Club members were each presented with a gold watch by General Thomas S. Hammond, Chairman of the Board of Directors at the Club's Second Annual Meeting, held February 21.

International Harvester Co.'s new Louisville, Ky., works poured its first metal January 17. Completely mechanized, the foundry will employ some 1,600 workers when it reaches capacity in the near future. The foundry has a floor area of 335,000 sq ft, all under one roof, and includes sand storage, pattern shop, core room, molding department, melting department (with six cupolas), cleaning, maintenance and service departments and offices. Peak casting capacity of the new plant is 400 tons every 16 hours, and will consist of castings for Farmall tractor parts and engines. Embodying the latest in foundry developments, the ultra-modern plant was designed to Harvester specifications by the National Engineering Co.

Mine Safety Appliances Co., Pittsburgh, is planning construction of a four-story laboratory building devoted to research on safety and hygiene equipment. Said to be the largest laboratory of its kind in the world, the new building will house quality control, chemical, physical, rubber and plastics, mine safety and electrical departments and is expected to be completed in September of this year.

Standard Pattern Works' Machine Division has moved into new quarters at 13781 Concord Ave., Detroit. The Division has a fully-equipped engineering department, pattern shop and machine shop, and is prepared to rebuild, replace worn or broken parts, make new stripping plates, stools, and mount pattern equipment to suit production requirements. The new clear-span building is provided with large truck doors that will accommodate all types of

American Foundry Co., Inc.'s $15 million Indianapolis plant will produce 500 tons of castings per day for Chrysler Corporation products when completed. (Photograph courtesy of Indianapolis News.)

hauling equipment. A heavy crane permits quick handling with minimum manpower and there is ample air and electric power to carry any machine through a complete cycle of test checking. The Division will specialize in the rebuilding of molding machines and core equipment.

Whiting Corporation (Canada), Ltd., announces the removal of its headquarters to 47-49 LaPlante Ave., Toronto, 2, Ont.

Gibbs Foundry, Galva, Ill., a division of the George W. Borg Co., Delavan, Wis., was recently destroyed by fire. Losses were estimated at $100,000. The one-story brick building was built in 1888 and for several years had been used to make furnaces.

Furnace Engineers, Inc., recently purchased the office building at 1551 W. Liberty Ave., Pittsburgh, which houses its engineering and general offices.

Every one of the approximately 35,000 employees of the **Allis-Chalmers Mfg. Co.** in the United States has been offered health and accident insurance under a plan by which the company pays 50 per cent of the net cost.

McCall-Boykin Co., Inc., Calvert and 20th Streets, Baltimore, Md., has been appointed distributor for Hyster lift trucks for Maryland, excepting Washington, Allegany and Garrett counties; Kent and Sussex counties in Delaware; Acomac and Northampton counties, Virginia; and the District of Columbia.

Falk Corp., Milwaukee, Wis., recently issued an illustrated brochure, "This Is Falk . . . We Work Together For Security," for distribution to its employees. This outstanding example of employee relations literature describes the company's employee insurance, its profit-sharing plan, its retirement plan, and the opportunities open to every worker at Falk.

Airco Export Corporation changed its name as of October 1 to **Airco Corporation (International).** The name change in no way affects the corporate structure, functions or personnel of the coporation, which is the wholly-owned import-export subsidiary of **Air Reduction Co., Inc.**

Robins Engineers Division of Hewitt-Robins, Inc., has tripled its backlog of contracts in the first eight months of its existence, according to Division Vice-President and General Manager Harold Von Thaden. The Engineers Division, which designs and furnishes complete materials handling systems, now has 35 major contracts, with individual projects involving as much as $450,000.

Formation of **Ivan Bloch and Associates,** Industrial Consultants, at 729 S.W. Alder St., Portland, Ore., is announced by Mr. Bloch, who formerly served as special consultant to the Secretary of the Interior, and as chief of the Division of Industrial and Resources Development, U. S. Bonneville Power Administration. The purpose of the organization is to aid in the development of industries, markets and communities in the Pacific Northwest and Alaska.

Automatic Sprinkler Company of America announces the opening of its new plant and offices at 5140 N. Wolcott Ave., Chicago 40, Ill.

Showing a modern foundry at work, an illustrated brochure, published recently by the **Eaton Manufacturing Company,** Vassar, Mich., takes the reader on a "picture tour" of Eaton's Permanent Mold Foundry. Eighteen pages are devoted to pastel sketches of the plant's offices, employee facilities, stock rooms, and to the various foundry departments at work. Included are sketches of the mold shop, laboratory, stockpiles, cupolas, blowers, core room, permanent mold machines, conveyor, annealing furnaces, tumblers, grinders, abrasive cleaning machines and inspection department.

Heaps, Waterous Limited is the new designation of **Heaps, Engineering (1940) Limited,** of New Westminster, B. C., Can., it is announced.

Manitowoc Gray Iron Foundry, Inc., is the new name of **Dunrite Industries, Inc.** Management, ownership and address—Ninth and Commercial Streets, Manitowoc, Wis., remain the same.

Call a Swan-Finch Engineer

Casting output was severely hampered in a large mid-Western foundry due to the limited capacity of the core room — in-and-out time was too slow. In this case, reduced baking time was the only logical answer and it called for a change in core mixes.

A Swan-Finch engineer analyzed the problem...recommended specific mixtures of Safco Core Oil and Tykor Compound for tractor manifold, machine tool base and carburetor cores.

In all cases, baking time was substantially reduced—on some cores as much as 50% (one 2-hour cycle instead of two at 500°F.). Cores ranged in size from ¼ lb. to 300 lb. Overbake was not critical. Cores had hard surfaces and sharp edges...shakeout was improved. Sand worked smoothly in boxes and blowers...drew clean. And what's more, the S-F binders averaged 11% more economical than the product formerly used.

When your core room becomes a "waiting room," call a Swan-Finch engineer. His recommendations can mean faster in-and-out...higher production...new economy...new efficiency in your overall operation through improvements in your core room.

SWAN-FINCH OIL CORPORATION

Chapter Meetings

APRIL 15

BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham
J. B. Caine
Sawbrook Steel Castings Co.
"Scabs, Buckles and Spalls"

TENNESSEE
Hotel Patten, Chattanooga
Clyde A. Sanders
American Colloid Co.
"Foundry Sand Practice"

TRI-STATE
Alvin Hotel, Tulsa, Okla.
R. J. Rice
International Nickel Co.
"Alloys"

APRIL 18

QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
Charles B. Schureman
Baroid Sales Division, National Lead Co.
"Sand Control"

APRIL 19

EASTERN NEW YORK
Circle Inn, Lathams Corners
L. L. Clark
General Motors Corp.
"Cupola Operations and Control"

CENTRAL MICHIGAN
Union Bldg., Michigan State College
Fred Walls
International Nickel Co.
"Cupola Operations and Nodular Iron"

APRIL 21

OREGON
Heathman Hotel, Portland
Dr. Webster J. Daly
Daly Industrial X-Ray System
"Practical X-Ray Equipment and Methods for the Foundry"

DETROIT
Rackham Memorial Bldg.
Production Problems Round Tables

APRIL 25

CENTRAL ILLINOIS
Pere Marquette Hotel, Peoria
Frederick A. Faville
Faville-LeValley Corp.
"Our First Duty—Keep America Smiling"

NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
C. O. Bartlett
C. O. Bartlett & Snow Co.
"Foundry Mechanization"

MAY 4

TOLEDO
Toledo Yacht Club, Toledo
Speaker to be announced
"Centrifugal Casting of Sewer Pipe"

MAY 5

TWIN CITY
Covered Wagon, Minneapolis
Roy Jones
Giffels & Vallet, Inc.
"Mechanization for Small Foundries"

MAY 9

CINCINNATI DISTRICT
Engineering Society, Cincinnati
C. R. Simmons
Durez Plastics & Chemicals, Inc.
"Plastic Patterns"

METROPOLITAN
Essex House, Newark, N. J.
W. H. Johnson
Naval Research Laboratory
Motion Picture: *"Gating Systems for Metal Castings"*

WESTERN MICHIGAN
Cottage Inn, Muskegon
Zigmund Madacey
Caterpillar Tractor Co.
"Cores and Core Boxes"

CENTRAL OHIO
Chittenden Hotel, Columbus
Nathan Janco
Centrifugal Casting Machine Co.
"Centrifugal Castings"

MAY 10

N. ILLINOIS—S. WISCONSIN
Beloit, Wis.
H. N. Bogart
Ford Motor Co.
"Steel Foundry Practice and Molten Metal Temperature Measurement"

ROCHESTER
Seneca Hotel, Rochester
A. W. Gregg
Whiting Corp.
"Foundry Training"

MAY 12

NORTHEASTERN OHIO
Cleveland Club, Cleveland
Past Presidents and Old Timers Night

SAGINAW VALLEY
Fischer's Hotel, Frankenmuth, Mich.
Round Table Meetings

MAY 13

WISCONSIN
Schroeder Hotel, Milwaukee
Old Timers and Apprentices Night

ONTARIO
Royal York Hotel, Toronto
Annual Meeting

PHILADELPHIA
Engineers' Club
A. N. Kraft
Wilkening Mfg. Co.
"Cleaning Department Problems"

CENTRAL NEW YORK
Onondaga Hotel, Syracuse
Fred G. Sefing
International Nickel Co.
"The Significance of Test Bars in Relation to Casting Properties"

EASTERN CANADA & NEWFOUNDLAND
Mount Royal Hotel, Montreal
Annual General Meeting and Presentation of Prizes to Apprentice and Technical Papers Contest Winners

MAY 16

CHICAGO
Chicago Bar Association
Round Table Meetings

MAY 19

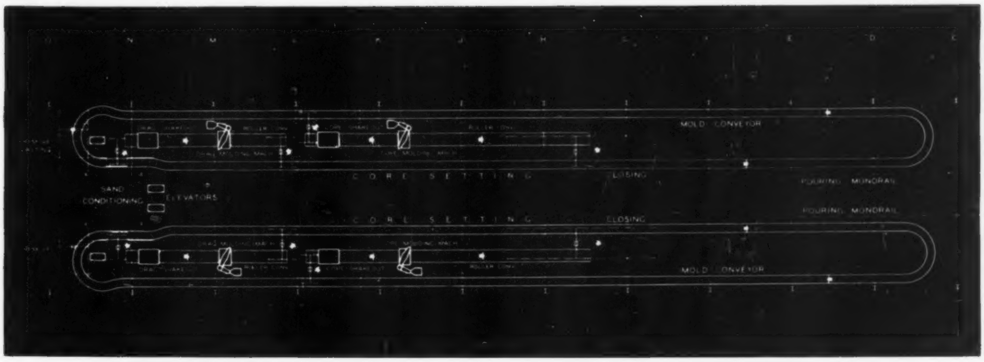
OREGON
Heathman Hotel, Portland
George Dalbey
Mare Island Navy Yard
"Solidification of Metals"

MAY 20

BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham
Clyde A. Sanders
American Colloid Co.
"Sand Control"

MAY 20

TRI-STATE
Hotel Dale, Coffeyville, Kan.
H. E. Elliott
Dow Chemical Co.
"Gates and Risers"



CAMPBELL, WYANT & CANNON FOUNDRY COMPANY, MUSKEGON, MICHIGAN

Improved quality and increased production were the objectives in the engineering and construction of these new cylinder block molding systems.

The many features contributing to high quality production on these molding units were accomplished through the combined efforts of the Owner's production engineers and the foundry engineers of Giffels & Vallet, Inc.

Foundry improvements should be engineered to accomplish desired results and planned for a minimum of interference to existing production in the foundry.

GIFFELS & VALLET, INC.

INDUSTRIAL ENGINEERING DIVISION

1000 MARQUETTE BUILDING, DETROIT

PERSONALITIES

(Continued from Page 141)

pany's Board of Directors. Mr. Dunn has been with Brake Shoe since his graduation from Yale University in 1932. He has been treasurer since 1942, and secretary-treasurer since 1947. Mr. Brush joined Brake Shoe in 1946, after service with the Navy, as an attorney, and became assistant secretary of the company in 1947. He is a graduate of Cornell University and a member of the New York Bar.

A. M. Callis, sales manager of the Chicago territory of the Federated Metals Division of the American Smelting & Refining Co., has been appointed to the newly-created post of general sales manager for the company. Other transfers made known at the same time were those of **J. W. Kelin,** former sales manager of the St. Louis territory, to Mr. Callis' post, and **Paul H. Jackson,** district sales manager at Seattle, to succeed Mr. Kelin at St. Louis.

Joe Ramalho, engineer for Brazil's Sociedade Anonima Comercio e Industrias Souza Noschese, Sao Paulo, makers of sanitary ware, was a recent visitor to A.F.S. Headquarters, Chicago, while on a visit to this country for the purpose of studying U.S. mechanized foundries.

George C. Delp, president of the New Holland Machine Co., New Holland, Pa., has been elected a vice-president of the Sperry Corp. New Holland, which makes heavy industrial and farm equipment, has been a Sperry subsidiary since 1947. Mr. Delp holds partnerships and executive positions in several equipment manufacturing firms in Pennsylvania and Ohio. He is a member of the Industrial Capital Committee of the National Association of Manufacturers.

William J. McGraw, manager of electric tool sales for Independent Pneumatic Tool Co.'s New York territory, has been appointed manager of the company's Cleveland branch. He is succeeded in New York by **E. B. Rosell,** formerly Chicago territory electric tool service engineer.

John P. Wilkinson has been appointed assistant to the president, and James M. Lewis manager of Roll Sales for the Lewis Foundry & Machine Division of Blaw-Knox Co. Mr. Wilkinson, a graduate of the University of Alabama, was until recently engaged in supervising installation of a new merchant mill in Mexico City. Mr. Lewis, a graduate of Grove City College, has been with Blaw-Knox since 1931.

G. W. Merrefield has been appointed consulting engineer to the foundry industry by Giffels and Vallet, Inc., Detroit. He has served with U.S. Steel, Clark Equipment Co., American Radiator Co., and the Chicago Hardware Foundry.

Glenn C. Shiveley, has been appointed purchasing agent of the Superior Steel & Malleable Castings Co., Benton Harbor, Mich., it was recently announced.

R. B. Brown, formerly with the Eclipse-Pioneer Division of Bendix Aviation Corp., has been appointed executive vice-president of The Magnesium Association, succeeding T. W. Atkins, who recently resigned to enter his own business as a banker in Painesville, Ohio.

J. T. Jones, formerly with the Open Hearth department of Republic Steel Corp.'s South Chicago Works, has joined the sales force of Vesuvius Crucible Co., Pittsburgh, makers of crucibles and graphite stopper heads.

Alfred C. Eastwood, for the last two years sales representative for the Lake territory of the Tabor Mfg. Co., Philadelphia, has moved his headquarters to 2331 McKinley Ave., Lakewood, Ohio. Mr. Eastwood was formerly an instructor in the operation of Tabor-Brasive machines.

Carl H. Spannaus, Fountain Iron & Brass Foundry, Pueblo, Colo., has been elected chairman of the newly-organized Denver Management Group of the Gray Iron Founder's Society. Simultaneously, it was announced that **Donald A. Paull** of Sealed Power Corp., will head the GIFS Muskegon Management Group.

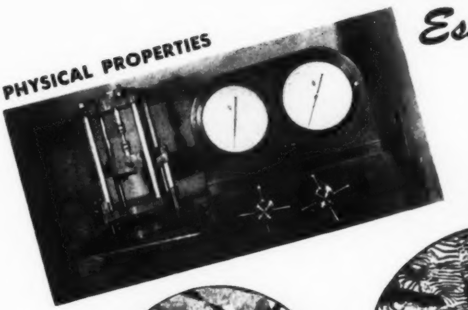
James W. Moran was recently elected president of the Baker-Raulang Co., succeeding **E. J. Bartlett,** who becomes president emeritus and who will retain a direc-

(Continued on Page 176)

CONTROL
Essentials

★

PHYSICAL PROPERTIES



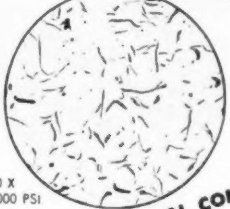
MICRO STRUCTURES

CAST IRON

FOUNDRY PROCEDURES

500 X
18100 PSI

1000 X
42800 PSI



100 X
55000 PSI

CHEMICAL COMPOSITION

Charles C. Kawin Co.

Metallurgical Chemists, Foundry and Metallurgical Engineers, Metallographers, Physical Tests

431 SOUTH DEARBORN STREET, CHICAGO 5, ILLINOIS · 110 PEARL STREET, BUFFALO 2, NEW YORK

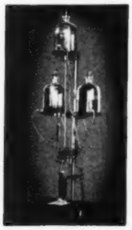
Better testing equipment

to improve your products

Compare the prices shown here with those currently quoted for other units of test equipment designed for the same general purposes. These prices are not only lower but the performance of Dietert control equipment is in every case equal to or superior to any other units available.

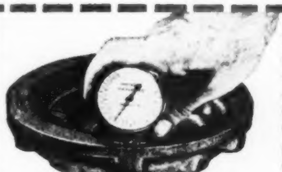
With the Dietert Carbon Determinator, you can run ACCURATE quantitative carbon tests on metals or other materials in the short space of two minutes.

The PRICE is $235.00



The Dietert Sulfur Determinator provides you with the means of getting the sulfur content of metals and other materials with precision. The equipment and the analytical procedure meets the tentative ASTM Standards for the determination of sulfur in steels.

The PRICE is $153.00



The Dietert Brinell Hardness Reader can be used successfully by any one in your plant who can read a dial. No judgment is necessary, no charts or tables to consult and no figuring to do. It makes hardness testing foolproof. The Brinell Hardness Reader replaces the measuring microscope. It measures the depth of the Brinell impression rather than the diameter. The dial is graduated in Brinell Hardness Numbers.

The PRICE is $48.00

5199

We will rush detailed specifications to you on these units if you will write to Department I.

Harry W. DIETERT Company
9330 Roselawn Ave. *Detroit 4, Michigan*
CONTROL EQUIPMENT · SAND · MOLD · MOISTURE · CARBON · SULFUR

CARPENTER Brothers Inc.

606 W. WISCONSIN AVE., MILWAUKEE 3, WIS.
FOUNDED IN 1917

BINDERS & COMPOUNDS

FORDATH IN THE CORE-MIX

OIL-SAND MIXING TECHNIQUE *is vital to good work in the foundry.* With the modern range of GLYSO products—semi-solids, creams, PERMOL and EXOL cereal binders—green bond and dry strengths of an oil-sand can be controlled between very wide limits. But the mixer must develop the full green bond inherent in a semi-solid compound; it must not crush the sand or a dangerous reduction in permeability may result. What is needed is the swift, silent and efficient FORDATH New Type MIXER, which rubs the sand and compound against inclined ribs in the mixing chamber, and promotes a vigorous tumbling action. Each grain of sand is coated with a film of binder, capillary action draws the oil in the GLYSO or EXOL between adjacent grains; and a thoroughly mixed, properly aerated charge of oil-sand is cleanly discharged after 2 to 3 minutes mixing. Five models, capacities 20 lbs. to 1 ton, with drive, gears and bearings fully enclosed and lubricated.

NEW TYPE MIXER

FORDATH IN THE FOUNDRY

Full details from THE FORDATH ENGINEERING CO. LTD.

Hamblet Works, West Bromwich, England — Cables & Telegrams: "Metallical" West Bromwich, England

PERSONALITIES

(Continued from Page 174)

torship in the company. Mr. Moran joined the company in 1911 as a stock record clerk and has been secretary, treasurer and a director of Baker Raulang since 1934.

T. W. Atkins, executive vice-president of the Magnesium Association, has announced that he has resigned from office, effective January 1, to become president of the Citizen's Saving and Loan Co., of Painesville, Ohio. Mr. Atkins held the executive vice-presidency of the Association for more than three years.

Robert C. Becherer, an employ of the Link-Belt Co.'s Ewart plant, Indianapolis, since 1923, has been appointed general manager there.

Harry C. Barney, a new A.F.S. student member from the University of Cincinnati, is following out the foundry training program recommended by A.F.S. and the Foundry Educational Foundation by gaining practical experience as a cooperative student employee at the Cincinnati Milling Machine Co.

Adrian J. Archambault, formerly foundry instructor at the Wisconsin Vocational School, Milwaukee, has been appointed foundry manager and instructor at the Hackley Technical School, Muskegon, Mich. Mr. Archambault has transferred his A.F.S. membership from Wisconsin to the Western Michigan chapter.

Oscar Blohm, owner and operator of the Triangle Foundry Co., Chicago, recently sold his interests in the company and has become a foundry consultant.

J. Whittles, foundry superintendent of Howard Auto Cultivators, Ltd., Northmead, New South Wales, Australia, was a recent visitor to A.F.S. Headquarters.

Charles A. Licht, formerly a member of the A.F.S. student chapter at the Massachusetts Institute of Technology, is now employed as an engineer at the Indiana Harbor Works, American Steel Foundries, and has joined the Chicago Chapter.

L. O. Sturkie, formerly foundry engineer for the Hughes Tool Co., Houston, Texas, has been appointed vice-president and general manager of Quality Electric Steel Castings, Inc., Houston.

R. B. Hutchinson, formerly of the Chattanooga Implement and Mfg. Co., recently accepted a position with Cherokee Foundries, Inc., Chattanooga.

Frank S. O'Neil, Vice-President and General Manager of the Indianapolis plants of the Link Belt Co., retired on December 31 after 42 years of service with the company. Mr. O'Neil entered the employ of the company's Pershing Road plant in Chicago in 1906 in the production department of the foundry. In 1916, he was transferred to the Dodge plant at

Indianapolis, and that same year became assistant superintendent of what is now the Ewart plant. Mr. O'Neil later became superintendent and general manager of the Indianapolis operations, before his election as a vice-president in 1943.

W. E. Madden has been appointed vice president of George Haiss Mfg. Co., Inc., materials handling subsidiary of Pettibone Mulliken Corp., Chicago. Mr. Madden was made sales manager of Haiss' Conveyor division last year and was instrumental in the development of a new line of Haiss conveyors.

C. A. Johnson, assistant to the director of Quality Control for the United States Pipe & Foundry Co., was recently transferred from the company's general offices at Burlington, N. J., to Bessemer, Ala.

F. Leicester Cuthbert of the Baroid Sales Division of the National Lead Co. Los Angeles, was recently transferred to Houston, Texas, where he will head the Research and Development department.

T. L. Godden, Cleveland district manager for Thiem Products Co., recently transferred to the Pittsburgh district.

Harry D. Sweeney has been appointed sales manager of Welding Products for the American Manganese Steel Division of the American Brake Shoe Co. Mr. Sweeney, who was formerly sales engineer, has been with Brake Shoe since 1945. During World War II, he served as a First Lieutenant with the Army in England and France. Mr. Sweeney will continue to be located at the Division's headquarters in Chicago Heights, Ill.

L. G. Jessup, formerly with the Federated Metals Division of the American Smelting & Refining Co., Whiting, Ind., has been appointed sales engineer and foundry advisor for the Western Metal Co., Chicago, Ill.

Fred J. Menninger has been promoted to the position of assistant plant manager at the Newark, N.J., plant of the Federated Metals Division of the American Smelting & Refining Co. The post of plant superintendent, formerly held by Mr. Menninger will be filled by **Earl Marble, Jr.,** who has been serving as assistant to the manager of technical operations.

David W. McDowell, Jr., formerly a member of the faculty of the Department of Mechanical Engineering at Iowa State College, has been appointed assistant professor of Mechanical Engineering at the University of Buffalo, Buffalo, N. Y.

OBITUARIES

Richard O'Brien, cleaning shop foreman and one of the oldest employees of the Longue Point plant of the Canadian Car & Foundry Co., Ltd., died recently in Montreal. Mr. O'Brien had been with the company for 46 years.

H. Schuyler Robertson, 55, vice-president of the Harbison-Walker Refractories Co., died February 21 while vacationing in Guatemala. A graduate of the University of Illinois, Mr. Robertson served in the Air Corps during World War I, and began his career by joining Harbison-Walker as a sales correspondent shortly

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238	— 13½"x24"x6"	41	— 36"x36"x16"
81	— 16"x16"x5"	58	— 36"x72"x12"
152	— 18"x32"x6"	60	— 48"x48"x12"
184	— 23"x34"x4"	15	— 48"x72"x12"
306	— 24"x24"x8"	6	— 108"x96"x12"
106	— 24"x24"x12"	3	— 114"x102"x16"

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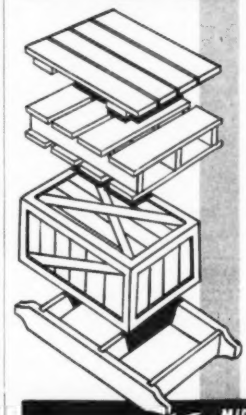

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afterwards. In 1940, he was promoted to general sales manager and was elected a director in 1943, and vice-president in 1948. He was a member of the War Production Board during World War II.

Arthur S. Nichols, 48, vice-president and sales manager of the Illinois Clay Products Co., Chicago, for more than 23 years, died February 18. A graduate of the University of Illinois, Mr. Nichols was chairman of the AIMME Committee on Ceramic Materials and a past chairman of AIMME's Chicago Chapter.

Anton Vitu, for many years Core Room Superintendent of the Fulton Foundry & Machine Co., Cleveland, Ohio, died at his home in that city on January 8.

George Michael Hayes, 46, foundry sales representative and metallurgist, died at his home in Tuscaloosa, Ala., of a heart attack. A veteran of more than 25 years in the foundry industry, Mr. Hayes began his career with the Central Foundry Co., Holt, Ala., where his father was for years general manager. During World War II, Mr. Hayes was metallurgist with Thomas Foundries, Inc., Birmingham, and later veterans coordinator with the Tuscaloosa County Board of Education and head of the Veterans Training Program at the University of Alabama. Mr. Hayes left that post in September of last year to join the firm of Kerchner, Marshall & Co., Birmingham, as foundry sales representative. Mr. Hayes was the author of a widely used textbook on foundry practice.

Arthur T. Waterfall, 79, National President of the American Foundrymen's Association in 1910 and acting president of the Dodge Brothers Corp., Detroit, at the time of his retirement in 1928, died January 28 at his home in Detroit. Mr. Waterfall began his career in the foundry industry as an apprentice helper in an iron foundry and was for 25 years with the Russell Wheel & Foundry Co., Detroit, the last eight years as general superintendent. In 1912, Mr. Waterfall was appointed traffic commissioner of the Detroit Board of Commerce, and four years later joined Dodge Brothers as traffic manager. He later served as vice-president and general manager and retired as acting president. He was a former president of the Michigan Manufacturers' Association and the Detroit Foundrymen's Association.

Frederick E. Rundquist, 63, foundry manager of Greenlee Bros. & Co., Rockford, Ill., and a past chairman of the Northern-Illinois—Southern Wisconsin Chapter of the American Foundrymen's Society, died March 21 at a hospital in Phoenix, Ariz., where he had gone to recuperate from a heart attack suffered a few weeks previously. Mr. Rundquist joined Greenlee Bros. in 1910 and advanced to management of the company's Foundry Division. He was a member of the Board of the Foundry Educational Foundation at the time of his death. Two of Mr. Rundquist's sons, Frederick N. and John W., are partners in the Beloit Castings Co., and a third son, Richard, is associated with Greenlee Bros.

ABSTRACTS

Iron Founding

Basic Grade Pig Iron. J. E. Rehder, "The Use of Basic Grade Pig Iron in Iron Founding," *Canadian Metals & Metallurgical Industries,* vol. 11, no. 6, June, 1948, pp. 24, 30.

Canadian iron founders who revised their melting mixtures in order to use available stock find that with suitable handling the basic grade pig iron is a successful substitute for the foundry grade or malleable pig iron formerly used.

Five standard grades of pig iron can be used as well as one synthetic pig iron which is made in an electric furnace from scrap iron and scrap steel.

The chief differences between the foundry and basic grade pig irons are in silicon, phosphorus, and manganese contents. The readily available and easily controlled forms of addition of these elements are briquets for silicon and manganese, and lump ferrophosphorus for phosphorus.

No other change in practice is necessary in the substitution of basic grade pig iron for foundry grade pig iron when the additions are made in the correct amounts to take care of the differences in the chemical composition. Tables show the amounts of the additions necessary when using basic grade pig iron.

Light gray iron foundries need to add heavy additions of silicon for freedom from chill, and phosphorus for fluidity.

The malleable iron foundry can use the basic grade pig iron for a part of the malleable grade pig iron in the cold melt air furnace and in the duplexing installations when suitable additions of silicon and manganese are made.

Oxygen

Converter Practice. Max E. Davies, "Oxygen in Side-Blown Converters," *The Iron Age,* vol. 162, no. 10, Sept. 2, 1948, pp. 87-91.

Catton & Co., Ltd., Leeds, England carried out extensive trials using oxygen in side-blown converters in cooperation with the British Iron and Steel Research Assn.

Previous experience indicated the possibility that lower initial temperatures might enable more scrap to be melted in the cupola and probably less ferrosilicon need be added to the charges. Experiments had shown however, the life of refractory tuyeres did not exceed one heat.

The side-blown converters used were of the size common in British steel foundries, and had a siliceous monolithic lining about 13 in. thick. The body and nose of this converter being short, the blowing loss averages 10 per cent and is higher than most types. Six silica brick tuyeres 2 in. in diam. were spaced about 10 in. from the bottom of the converter which increases its capacity from 4000 to 5000 lb during the life of the lining, which, in normal operation, and without general patching, is about 60 heats.

The oxygen comes from an evaporator

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of 14,000 cu ft capacity at a pressure of 300 psi which feeds at 20 psi through a pressure reduction valve to the pipe from the blower.

With higher percentages of oxygen, blowing losses were still excessive, and the rate of total blast had to be reduced. But the trials had shown that the oxygen enrichment was reducing the blowing time about one half of normal, and was raising the temperature 500 C as compared with the normal 300 C. This was obtained however, without the normal addition of about 0.4 per cent silicon to the bath, a considerable item in the United Kingdom where ferrosilicon is $121 per ton.

During trials the carbon flame at mouth of converter decreased for a period after start of blowing operation, then increased rapidly at end of what is generally recognized as the carbon elimination. For this reason the oxygen concentration was raised about midway during the operation. Under these conditions average blowing loss was only 7.5 per cent, a low figure.

During a series of trials when the charge was entirely of steel scrap, the temperature after desulphurizing was 1315 C, and silicon content was 0.16 per cent. The oxygen enriched blast gave a temperature increment of 325 C which enabled the metal to be cast satisfactorily.

Results show blowing time can be reduced by one half. Even though side-blown converters are installed in foundries where melting capacity is adequate, flexibility of the process in relation to variable demands in a foundry increases its value.

This also suggests that larger furnaces with oxygen enriched blast and basic lining could be used for bulk ingot production. The quality of liquid steel and ingots or castings made from it are comparable with those obtained from normally blown metal and are enhanced with higher temperature increments in foundries requiring high fluidity for manufacture of thin walled castings.

There was no noticeable decrease in average life of refractory linings, probably due to decrease in blowing time, even though the final temperature of the steel is much higher.

The disadvantage is the high cost of oxygen but there is a possibility of the useful development of the side-blown converter for larger scale use as is planned now for the production of alloy steels. The higher temperatures obtainable with the use of oxygen enrichment might make possible the exploitation by the basic Bessemer of the larger quantities of iron ore containing intermediate percentages of phosphorous.

Casting Bronze Propellers

CEMENT BONDED MOLDS. F. J. Tector and J. Martland, "The Casting of Marine Bronze Propellers," *Foundry Trade Journal*, vol. 85, no. 1664, July 22, 1948, pp. 73-80; vol. 85, no. 1665, July 29, 1948, pp. 99-104.

Propeller castings fall into a special class because they are required to be manufactured to such close tolerances of pitch, thickness, etc. They are highly stressed and are invariably subject to machining and finishing operations on the whole of the surfaces, are subject to heavy erosive, corrosive and galvanic action in service, and are very large.

No standardization of pattern and molding equipment is possible from a production point of view since very few would be ordered at one time.

The Manganese Bronze and Brass Co. used a sand-cement molding process in which ordinary Portland cement and water are added to pure silica sand of 20-50 mesh grade. The mixture has a compression strength of approximately 220 psi after 48-72 hours drying time at normal shop temperatures. When suitably reinforced with steel bars, it is sufficiently strong to withstand stresses imposed by large casting operations and the mold parts can be readily assembled. It is highly refractory and permeable and can be hand sleeked to suitable degree of smoothness.

This process eliminates stove drying, enables the majority of work to be done at floor level on a concrete floor. The molds are extremely rigid, castings are truer to dimensions than when made in the conventional loam molds.

New sand is used for facing purposes because of its refractoriness but the body of the mold is of reconditioned sand.

The company uses the "strickling process" in which it strikes-up the mold bed to the "face pitch" required.

A furnace charge is specially melted for

Brief Notes for Busy Foundrymen

GRAY IRON and the

advantages of Panther Creek . . .

Plants are required to employ several extra men and many hours of unnecessary labor in breaking-up lumpy sand and forcing it through the shake-out system. Many extra hours are required in removing green sand cores from castings that solidify around the molding sand thus baking it to a hard concrete-like aggregate. Even after removing these cores and sand, it must be beaten-up into smaller lumps before allowing it to return to the reclaiming system. The baked, stony-mass must be hauled to the sand dumps and disposed of. It is needless to mention the unnecessary expense in an operation of this nature.

Since foundries are able to obtain a bonding agent such as Panther Creek, which furnishes remarkable collapsibility, these conditions can be eliminated. Panther Creek may be added to either naturally bonded gray iron sands or synthetic gray iron sands.

In rebonding naturally bonded sands, only enough Panther Creek should be added to maintain satisfactory working green strength. This addition will probably never go beyond 2% and will mostly be under 1%, by weight. Once proper green strength is obtained, many foundries find it necessary to add only 100 lbs. of Panther Creek to each floor that contains approximately 9 tons of molding sand to maintain strength.

In rebonding synthetic sands the customary practice is to add 4 lbs. of Panther Creek per 96 lbs. of new sand with less than 3% temper water. For facings of one-half new sand and one-half old sand, when the latter contains some live clay, approximately 2% to 3½% is used.

If the practice of shaking bentonite on top of each mold after pouring is used, add about ½ pint of Panther Creek. A pint weighs 14 ounces. It is recommended that a mulling operation be used in all rebonding if possible.

Keep in mind the relationship between clay additions and water. More clay requires more water, less clay requires less water. Do not reduce one without reducing the other. Often it is found that by using less bonding agent in the sand and reducing the temper water, the molding sand is just as strong as it would be with more clay and more water.

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each propeller casting in a furnace with a suspended arch construction to allow roof openings to admit large pieces.

Successful operation, from a production point of view, of the process depends largely on atmospheric conditions which are favorable to adequate and consistent drying of the molds. Suitable temperatures and ventilation are essential.

The small propellers are made on a production line using a simple "oddside process". Mold parts are made by the sand-cement process by hand in batches on a conveyor. The production was increased by at least 40 per cent as compared with loam molding.

All foundry operations were organized and arranged in the most efficient way and casting schedules are arranged at least two weeks in advance.

The propeller design department and the foundry work in close cooperation. Variable pitches can be struck by combinations of pitch rails. Other variations are struck by means of compound rails. The propellers are now designed by fundamental instead of experimental methods.

In the final section a survey of the results of viscosity measurements of molten gray cast iron is made.

Esser found that, after heating, the viscosity of gray cast iron decreased slightly. Prolonged heating of molten cast iron makes it form white iron on freezing. The importance of his work is in corroborating Wimmer's results.

In the course of the experiments previously described it was found that: sulphur increases viscosity; phosphorus makes molten cast iron more fluid; and carbon lowers viscosity.

The only formula yet advanced from which the viscosity of molten metals can be calculated appears to be that of Andrade. His formula was corroborated by the experimental values, in cases mercury, lead, tin and copper. When iron was substituted it was found that the viscosity of pure iron at the melting point was 44 millipoise.

Methods suitable for viscometry include: the capillary principle; parallel plates gap; translational methods; rotational methods; and miscellaneous methods including oscillating fluid, wire film, and supersonic methods. Of these the rotational, and that of Wimmer are best.

Metallographic Polishing

Automatic Machine. E. D. Holt, "Automatic Polishing of Metallographic Samples," *Metal Progress*, vol. 54, no. 3, Sept., 1948, pp. 350-352.

The procedure for polishing metallographic specimens by automatic machine can be used for both ferrous and nonferrous metals.

In the first step an abrasive cutter is used to cut the specimen from the bar under water at 2200 rpm. This produces a smooth surface requiring no further preparation before mounting.

The specimen is mounted in bakelite by use of a thermostatically controlled pneumatic press. The mount, produced in a mold built into the press, has a cham-

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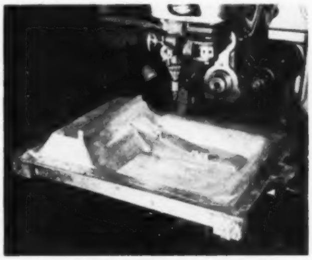

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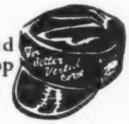

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fered edge on the surface to be polished. This prevents the edge from digging into the lap during polishing.

The polishing machine has a horizontal lap that rotates counterclockwise while the holder for the specimen is driven clockwise at slightly slower speed. This minimizes grooving of lap by specimens. The laps are removable and interchangeable.

Only four laps and two abrasives are needed between the cutting-off machine and the finished surface.

Specimens are loaded in a 6-unit or 12-unit holder of the polishing machine. Adjustments are made so that all parts to be polished are on one surface plane.

Laps are designed so that stones are cemented on backings and can be replaced when worn by a new stone on the same backing. Cloths can be either cemented to backings or clamped without cement.

The same 900-grit abrasive is used for the first three steps or laps. The first lap is alundum stone, the next lead, and the third of Vel-Chamee cloth. Specimens are washed thoroughly at the end of the third step, and final polishing is done with Precisionite polishing powder or kitten's-ear cloth which has been thoroughly rinsed. Soap solution may be added to aid cleaning, since the abrasive has a tendency to cling to and stain the specimens.

The specimens should be washed thoroughly, removed from holder, washed again, and dried. Normally they will be free from scratches, flat, without rounded edges and the inclusions will be retained. Photomicrographs up to 750x can be made without further polishing.

The procedure works well for cast irons, steels, brasses, and similar materials. Aluminum, magnesium, and soft copper do not need polishing with Vel-Chamee. Precisionite powder stains aluminum so a specially prepared levigated abrasive is used for polishing aluminum. Stellite and nitrided steel polish better on a cast iron surface than on a lead lap.

Graphite is retained in both malleable and gray cast irons; no metallic inclusions are retained and structure is clear.

BOOK REVIEWS

A.S.M. Review of Metal Literature, vol. 4, 1947. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. vi, 720 pp.

The *A.S.M. Review of Metal Literature* for 1947 includes the articles, technical papers appearing in journals and books received at the Battelle Memorial Institute during 1947.

Each entry contains an annotation so that the literature searcher can tell if the article is satisfactory for his purposes.

This volume has fewer pages but represents about a 35 per cent increase in articles because of the use of a two-column page and reduced margins. This aids in checking all references in a particular section with less effort.

There is also a noticeable increase in the number of magazines reviewed both in the English and in the foreign lan-

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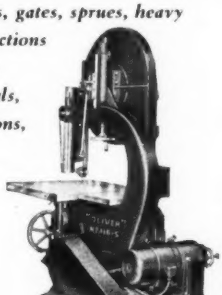

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gauges which indicates a more complete coverage of published articles in the metals fields during the year.

Handbook on Simpson Intensive Mixers for Sand Control. National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill. 64 pp. Gratis. (1948).

The important problems relating to the preparation of molding sands for gray iron, non-ferrous alloys, steel, and malleable iron are discussed in this book. Applications of the Simpson mixer and auxiliary equipment for each particular problem of sand control are described.

Handbook of Chemistry and Physics. 30th edition. Published by the Chemical Rubber Publishing Co., 2310 Superior Ave. N.E., Cleveland, Ohio, 1948. xviii, 2686 pp.

All branches of chemistry and physics and the closely allied sciences are included in the *Handbook of Chemistry and Physics.* The tables have been expanded about 40 per cent compared to the 29th edition. The material has been compiled by experts or selected from authoritative sources.

Foundry metallurgists may find the tables of the chemical and physical properties of the elements, metal-organic compounds, and melting points of mixtures of metals especially useful.

Almost all of the information in the book is in tabular form.

Wear. By Dr. F. P. Bundy, T. E. Eagan and Ralph L. Boyer. Cooper-Bessemer Corp. Mount Vernon, Ohio, 1948. 129 pp., 71 fig., $3.50.

The book discusses wear as it applies particularly to cylinders and piston rings.

The book is authoritative and well illustrated with pictures of equipment used in testing, photomicrographs, line drawings showing design features and numerous charts and graphs giving statistical data and test results.

In the first section, Dr. Bundy, General Electric Co., gives details and develops mathematically the theory of friction and wear of piston rings and cylinder walls. An important wear factor brought out is the width of the rubbing surfaces.

Mr. Eagan, chief metallurgist of Cooper-Bessemer Corp., explains in the second section that there are a number of conflicting hypotheses regarding fundamental causes of wear of cylinder liners, and he mentions corrosion of the liner and ring and destruction of the oil film.

He discusses wear patterns and points out that gray iron has been the standard material for liners for many years. Effect of microstructure is significant, all recent studies pointing to best results with a matrix of eutectoid composition with random graphite distribution. Citing results of researches reported in the literature on the effect of hardness and composition on wear resistance, he concludes that considerably more study is needed.

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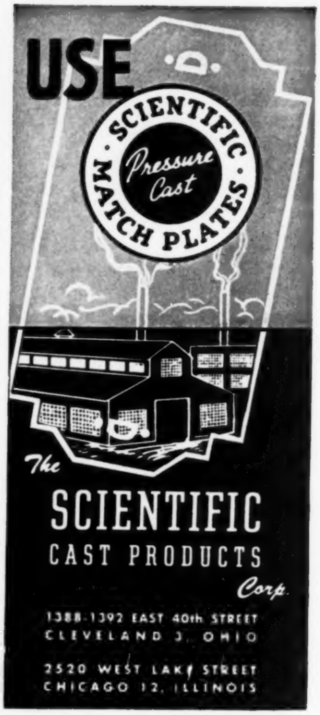

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FOUNDRY LITERATURE

(Continued from Page 156)

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Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.

Standard Conveyor Co., North St. Paul 9, Minn.
Syntron Co., 545 Lexington, Homer City, Pa.
United States Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y.
Jervis B. Webb Co., 8951 Alpine Ave., Detroit 4, Mich.
Yale & Towne Mfg. Co., Roosevelt Blvd. & Haldeman Ave., Philadelphia 15, Pa.

Core and Mold Washes

Bloomsbury Graphite Co., 30 Church St., Bloomsbury, New Jersey.
The Borden Company, Chemical Division, 350 Madison Ave., New York 17, N. Y.
The Dayton Oil Company, 1201 E. Monument Ave., Dayton, Ohio.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9, Wisc.
The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
The Hill & Griffith Co., Cincinnati, Chicago, St. Louis.
Houghland & Hardy—Hardy Sand Co., Evansville, Ind.
The J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22, Pa.
The S. Obermayer Co., 2563 West 18th Street, Chicago 8, Ill.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Stoller Chemical Co., 31 North Summit Street, Akron, Ohio.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4, Wis.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Penn.
The United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.

Core Binders, Oils and Compounds

American Cyanamid Co., Plastics Dept., 30 Rockefeller Plaza, New York 20, N. Y.
The Borden Company, Chemical Division, 350 Madison Ave., New York 17, N. Y.
Certified Core Oil Division, Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Illinois.
Corn Products Sales Company, 17 Battery Place, New York 4, N. Y.
The Dayton Oil Company, 1201 E. Monument Ave., Dayton, Ohio.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9, Wisc.
The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
The Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Hercules Powder Co., Wilmington 99, Del.
The Hill & Griffith Co., Cincinnati, Chicago, St. Louis.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chas. A. Krause Milling Co., Milwaukee, Wis.
Lauhoff Grain Co., P. O. Box 571, Danville, Ill.
The J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22, Pa.
The S. Obermayer Co., 2563 West 18th Street, Chicago 8, Ill.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Phila. 24, Pa.
Penola, Inc., 221 N. La Salle St., Chicago 1, Ill.
Werner G. Smith Co., 2191 West 110th Street, Cleveland 2, Ohio.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Stoller Chemical Co., 31 North Summit Street, Akron, Ohio.
Swan-Finch Oil Corp., RCA Bldg., West, New York 20, N. Y.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4, Wis.
United Oil Mfg. Co., 1429-31 Walnut St., Erie, Penn.
Velsicol Corp., 330 E. Grand Ave., Chicago, Ill.

Core Blowers

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Redford Iron & Equipment Co., 21315 W. McNichols Rd., Detroit 19, Mich.
The Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35, Pa.

Core Box Cleaner

E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.

Core Conveying Equipment

Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.
Mathews Conveyors Co., Ellwood City, Pa.
Palmer-Bee Co., 1701 Poland Ave., Detroit 12, Mich.

Core Grinders

Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

Core Knockout Equipment

The Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.
The Hydro-Blast Corp., 2550 N. Western Ave., Chicago, Ill.
Pangborn Corp., Hagerstown, Md.

Core Making Machines

Arcade Mfg. Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee, Wisc.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
The Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
The Johnston & Jennings Co., 877 Addison Rd., Cleveland, Ohio.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
The Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35, Pa.

Core Ovens

Despatch Oven Co., 619 Eighth St., S. E., Minneapolis 14, Minn.
The Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y.
The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Core Paste

The Borden Company, Chemical Division, 350 Madison Ave., New York 17, N. Y.
Corn Products Sales Company, 17 Battery Place, New York 4, N. Y.
Eastern Clay Products, Inc., Jackson, Ohio.
George F. Pettinos, Inc., 1206 Locust Street, Philadelphia, Pa.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11, N. Y.

Core Plates

Christiansen Corporation, 1515 No. Kilpatrick Ave., Chicago 51, Ill.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14, Wis.

Core Racks

The Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.

Core Rod Straighteners and Shearing Machinery

Alter Co., 1701 Rockingham Rd., Davenport, Iowa.

Core Room Equipment

Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
The Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.

Core Sand Reclamation

The Frank G. Hough Co., Libertyville, Ill.
Houghland & Hardy—Hardy Sand Co., Evansville, Ind.
The Hydro-Blast Corp., 2550 N. Western Ave., Chicago, Ill.
Manley Sand Co., Rockton, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

Core Vents

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Wm. Demmler & Bros., Kewanee, Ill.
The PMS Co., 1071 Power Ave., Cleveland 14, Ohio.
United Compound Co., Inc., 328 S. Park Ave., Buffalo 4, N. Y.

Core Washes

Bloomsbury Graphite Co., 30 Church St., Bloomsbury, New Jersey.
The Borden Company, Chemical Division, 350 Madison Ave., New York 17, N. Y.
Corn Products Sales Company, 17 Battery Place, New York 4, N. Y.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9, Wisc.
The J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22, Pa.
Frederic B. Stevens, Inc., 1800 - 18th Street, Detroit 16, Mich.
The United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.

Couplings • Flexible

Ajax Flexible Coupling Co., Inc., English & Portage Sts., Westfield, New York.

Cranes • Foundry

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Harnischfeger Corp., P. O. Box 290, Milwaukee, Wis.
Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Cranes • Tractor

Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.

Crucibles

American Crucible Co., Washington Ave., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Jos. Dixon Crucible Co., Jersey City 3, N. J.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22, Pa.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18, Pa.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35, Pa.
Vesuvius Crucible Co., P. O. Box 8275, Swissvale, Pittsburgh 18, Pa.

Cupolas

Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Cupola Blowers

Allis Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee, Wis.
The J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22, Pa.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Avenue, Hartford 6, Conn.

Cupola Chargers

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Harnischfeger Corp., P. O. Box 290, Milwaukee, Wis.
Modern Equipment Co., Port Washington, Wis.

Cupola Control Equipment

The Foxboro Co., Neponset Ave., Foxboro, Mass.

Cupola Dust Collectors

The C. O. Bartlett & Snow Company, 6200 Harvard Avenue, Cleveland, Ohio.
Claude B. Schneible Co., 2827 - 25th Street, Detroit, Mich.

Cutoff Machines

The Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
Grob Brothers, Grafton, Wis.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
The Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35, Pa.

Dust Collecting Equipment • Dry

Alloy Metal Abrasive Co., 311 West Huron Street, Ann Arbor, Michigan.
American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Indiana.
The Johnson-March Corp., 1724 Chestnut St., Philadelphia 3, Pa.
The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.
The Macleod Co., 2232-40 Bogen St., Cincinnati 22, Ohio.
The W. W. Sly Manufacturing Co., 4700 Irwin Ave., Cleveland 2, Ohio.
U. S. Hoffman Machinery Corp., 99 Fourth Ave., New York 3, N. Y.

Dust Collecting Equipment • Wet

American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.
The C. O. Bartlett & Snow Company, 6200 Harvard Avenue, Cleveland, Ohio.
The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.
Claude B. Schneible Co., 2827 - 25th Street, Detroit, Mich.

Electrodes

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.
Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Penna.
International Graphite & Electrode Corp., St. Marys, Pa.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Engineering Service • Foundry

Frank D. Campbell, 332 S. Michigan Ave., Chicago, Ill.
The Fellows Corp., 1012 N. Third St., Milwaukee 3, Wisc.
Giffels & Vallet, Marquette Bldg., Detroit, Mich.
Charles C. Kawin Co., 431 S. Dearborn St., Chicago 5, Ill.
Lester B. Knight & Associates, Inc., 600 W. Jackson Blvd., Chicago, Ill.; 30 Church St., New York, N. Y.
W. G. Reichert Engineering Co., 1060 Broad St., Newark 2, N. J.

Exothermic Materials (Pipe Eliminators)

Exomet, Inc., Maple Ave., Conneaut, Ohio.
Exothermic Research Products, 785 Northland Ave., Buffalo 11, N. Y.

Facings • Foundry

Asbury Graphite Mills Inc., Asbury, Warren Co., New Jersey.
Bloomsbury Graphite Co., 30 Church St., Bloomsbury, New Jersey.
The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
The Hill & Griffith Co., Cincinnati, Chicago, St. Louis.
The S. Obermayer Co., 2563 West 18th Street, Chicago 8, Ill.
Penn-Rillton Co., 324 W. 23rd., New York 11, N. Y.
George F. Pettinos, Inc., 1206 Locust Street, Philadelphia, Pa.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Frederic B. Stevens, Inc., 1800 - 18th Street, Detroit 16, Mich.
Stoller Chemical Co., 31 North Summit Street, Akron, Ohio.
The United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11, N. Y.

Ferro-Alloys

Climax Molybdenum Company, 500 Fifth Ave., New York, N. Y.
Hickman, Williams & Co., 1500 Walnut St., Philadelphia 2, Pa.
The Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro-Metals Co., 429 South 4th St., Keokuk, Iowa.
Tennessee Products & Chemical Corporation, American National Bank Bldg., Nashville, Tenn.

Fire Brick

G. & W. H. Corson, Inc., Plymouth Meeting, Pa.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
The Ironton Fire Brick Co., Ironton, Ohio.
The Pyro Refractories Co., Oak Hill, Ohio.
Quigley Company, Inc., 527 Fifth Ave., New York 17, N. Y.

Flask Bushings

Universal Engineering Co., Frankenmuth, Mich.

Flask Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5, Ohio.

Flask Pins

Universal Engineering Co., Frankenmuth, Mich.

Flask Trimmings and Jackets

The Adams Company, 100 East 4th Street, Dubuque, Iowa.
Arcade Mfg. Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee, Wisc.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
The Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
The Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

Flasks • Aluminum

The Adams Company, 100 East 4th Street, Dubuque, Iowa.
The Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.
The Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

Flasks • Magnesium

The Fremont Flask Co., 1000 Wolfe Ave., Fremont, Ohio.

Flasks • Steel

The Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14, Wis.

Flasks • Wood

The Adams Company, 100 East 4th Street, Dubuque, Iowa.
Arcade Mfg. Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee, Wisc.
Diamond Clamp & Flask Co., Box 256, Richmond, Ind.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5, Ohio.
The S. Obermayer Co., 2563 West 18th Street, Chicago 8, Ill.

Flexible Shaft Equipment

Pratt & Whitney, Div. Niles Bement Pond Co., West Hartford 1, Conn.

Fluxes • Cupola

The Cleveland Flux Company, 1026-34 Main Ave., N. W., Cleveland, Ohio.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati, Ohio.
Pittsburgh Metals Purifying Corp., 1352 Marvista St., N.S., Pittsburgh 12, Pa.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4, Wis.

Fluxes • Ladle

The Cleveland Flux Company, 1026-34 Main Ave., N. W., Cleveland, Ohio.
Exothermic Research Products, 785 Northland Ave., Buffalo 11, N. Y.

Fluxes • Non-Ferrous

Apex Smelting Company, 2537 W. Taylor St., Chicago 12, Illinois.
The Cleveland Flux Company, 1026-34 Main Ave., N. W., Cleveland, Ohio.
Exothermic Research Products, 785 Northland Ave., Buffalo 11, N. Y.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago, Ill.
Pittsburgh Metals Purifying Corp., 1352 Marvista St., N.S., Pittsburgh 12, Pa.
Thiem Products, Inc., 746 W. Virginia St., Milwaukee 4, Wis.

Fluxes • Welding

The Linde Air Products Company, Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Pittsburgh Metals Purifying Corp., 1352 Marvista St., N.S., Pittsburgh 12, Pa.

Foundry Supplies • General

Alter Co., 1701 Rockingham Rd., Davenport, Iowa.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9, Wisc.

The Hill & Griffith Co., Cincinnati, Chicago, St. Louis.
Frederic B. Stevens, Inc., 1800 - 18th Street, Detroit 16, Mich.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
Jervis B. Webb Co., 8951 Alpine Ave., Detroit 4, Mich.

Furnace Linings

Alpha-Lux Co., Inc., 155 John St., New York 1, N. Y.
American Crucible Co., Washington Ave., North Haven, Conn.
Bay State Crucible Co., Taunton, Mass.
Campbell-Hausfeld Co., 801 Moore, Harrison, Ohio.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22, Pa.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18, Pa.
The Ramtite Co., Div. of the S. Obermayer Co., 2563 W. 18th St., Chicago, Ill.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Aluminum and Magnesium Melting

Ajax Metal Co., Frankford Ave. & Richmond St., Philadelphia, Pa.
Campbell-Hausfeld Co., 801 Moore, Harrison, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12, Ill.
The Randall Foundry Equipment Corp., Newburgh Station, Cleveland, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Crucible

Campbell-Hausfeld Co., 801 Moore, Harrison, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12, Ill.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Electric

Ajax Metal Co., Frankford Ave. & Richmond St., Philadelphia, Pa.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12, Ill.
Pittsburgh Lectromelt Furnace Corp., Foot 32nd St., Pittsburgh, Pa.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Furnaces • Gas or Oil Fired

Campbell-Hausfeld Co., 801 Moore, Harrison, Ohio.
Despatch Oven Company, 619 Eighth St., S.E., Minneapolis 14, Minn.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12, Ill.
The Randall Foundry Equipment Corp., Newburgh Station, Cleveland, Ohio.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.
Stroman Furnace & Engineering Co., 9900 Franklin Ave., Franklin Park, Ill.

Furnaces • Heat Treating

Despatch Oven Company, 619 Eighth St., S. E., Minneapolis 14, Minn.
The DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
The Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 W. Hubbard St., Chicago 12, Ill.
Salem Engineering Co., 714 South Broadway, Salem, Ohio.

Goggles

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.
American Optical Company, 14 Mechanic Street, Southbridge, Mass.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn 1, N. Y.
Safety Clothing & Equipment Company, 7016 Euclid Ave., Cleveland 3, Ohio.

Graphite Products

Bloomsbury Graphite Co., 30 Church St., Bloomsbury, New Jersey.
Jos. Dixon Crucible Co., Jersey City 3, N. J.
The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.
The Hill & Griffith Co., Cincinnati, Chicago, St. Louis.
International Graphite & Electrode Corp., St. Marys, Pa.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22, Pa.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18, Pa.
George F. Pettinos, Inc., 1206 Locust Street, Philadelphia, Pa.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35, Pa.
The Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13, Ohio.
Springfield Facing Co., Williamsett, Mass. and Harrison, N. J.
The United States Graphite Co., 1621 Holland Ave., Saginaw, Mich.

Graphite Stopper Heads

Jos. Dixon Crucible Co., Jersey City 3, N. J.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35, Pa.
Vesuvius Crucible Co., P. O. Box 8275, Swissvale, Pittsburgh 18, Pa.

Grinders • Electric

Buckeye Tools Corp., 29 W. Apple Street, Dayton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., 175 North State St., Aurora, Ill.
The Standard Electrical Tool Co., 2488-96 River Rd., Cincinnati 4, Ohio.

Grinders • Flexible Shaft

Martindale Electric Co., 1347 Hird Ave., Cleveland 7, Ohio.

Grinders • Floor Stand

Fox Grinders Inc., 622 Oliver Bldg., Pittsburgh, Pa.

Grinders • Pneumatic

Buckeye Tools Corp., 29 W. Apple Street, Dayton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Texas.
Independent Pneumatic Tool Co., 175 North State St., Aurora, Ill.
Master Pneumatic Tool Co. Inc., Orwell, O.
The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

Grinders • Swing Frame

Fox Grinders Inc., 622 Oliver Bldg., Pittsburgh, Pa.

Grinding Wheels

The Carborundum Company, Niagara Falls, New York.
The Cleveland Quarries Company, 1740 E. Twelfth St., Cleveland 14, Ohio.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2, N. Y.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.
George Pfaff, Inc., 10-61 Jackson Ave., Long Island 1, N. Y.
Precision Grinding Wheel Co., Inc., 8301 Torresdale Ave., Philadelphia 36, Pa.
Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
United States Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y.

Hammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Texas.
The Dallett Company, Mascher at Lippincott St., Philadelphia, Pa.
Dayton Pneumatic Tool Company, P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Independent Pneumatic Tool Co., 175 North State St., Aurora, Ill.
Master Pneumatic Tool Co., Inc., Orwell, O.
Schramm Inc., West Chester, Pa.

Heaters • Ladle and Mold

The Macleod Co., 2232-40 Bogen St., Cincinnati 22, Ohio.

Helmets • Blasting

The Macleod Co., 2232-40 Bogen St., Cincinnati 22, Ohio.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn 1, N. Y.
The W. W. Sly Manufacturing Co., 4700 Irwin Ave., Cleveland 2, Ohio.

Helmets • Welding

American Optical Company, 14 Mechanic Street, Southbridge, Mass.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn 1, N. Y.
Safety Clothing & Equipment Company, 7016 Euclid Ave., Cleveland 3, Ohio.

Hoists • Chain or Electric

Chisholm-Moore Hoist Corp., Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Harnischfeger Corp., P. O. Box 290, Milwaukee, Wis.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.
Yale & Towne Mfg. Co., Roosevelt Blvd. & Haldeman Ave., Philadelphia 15, Pa.

Hoists • Pneumatic

Independent Pneumatic Tool Co., 175 North State St., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Hose • Oxygen and Acetylene

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.
Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.
United States Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y.

Hose • Pneumatic

Martin Engineering Co., 704 Rose St., Kewanee, Ill.
Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.
A. Schrader's Son, Div. of Scovill Manufacturing Co., Inc., 470 Vanderbilt Avenue, Brooklyn 17, N. Y.
Schramm Inc., West Chester, Pa.
United States Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y.

Ingots • Aluminum Alloy

Alter Co., 1701 Rockingham Rd., Davenport, Iowa.
Bohn Aluminum & Brass Corp., Aluminum Refiners Div., 1400 Lafayette Bldg., Detroit, Mich.
Bohn Aluminum & Brass Corp., Michigan Smelting & Refining Div., 1400 Lafayette, Detroit, Michigan.
Christiansen Corporation, 1515 No. Kilpatrick Ave., Chicago 51, Ill.
Colonial Smelting & Refining Co., Columbia, Pa.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5, N. Y.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago, Ill.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.
U. S. Reduction Co., Melville and Chicago Aves., East Chicago, Ind.
Hyman Viener & Sons, 5300 Hatcher, Richmond, Va.

Ingots • Non-Ferrous

Ajax Metal Co., Frankford Ave. & Richmond St., Philadelphia, Pa.
Bohn Aluminum & Brass Corp., Aluminum Refiners Div., 1400 Lafayette Bldg., Detroit, Mich.
Bohn Aluminum & Brass Corp., Michigan Smelting & Refining Div., 1400 Lafayette, Detroit, Michigan.
Christiansen Corporation, 1515 No. Kilpatrick Ave., Chicago 51, Ill.
Colonial Smelting & Refining Co., Columbia, Pa.
Samuel Greenfield Co., Inc., 31 Stone St., Buffalo, N. Y.
Federated Metals Division, American Smelting & Refining Co., Inc., 120 Broadway, New York 5, N. Y.
Benj. Harris & Co., 11th & State Sts., Chicago Heights, Ill.
R. Lavin & Sons, Inc., 3426 S. Kedzie Ave., Chicago, Ill.
Nassau Smelting & Refining Co., Inc., 1 Nassau Place, Tottenville, Staten Island, N. Y.
Niagara Falls Smelting & Refining Division, Continental Copper & Steel Industries, Inc., 2208 Elmwood Ave., Buffalo 17, N. Y.
North American Smelting Co., Marine Terminal, Wilmington 83, Del.
Silverstein & Pinsof, Inc., 1720 Elston, Chicago, Ill.
U. S. Reduction Co., Melville and Chicago Aves., East Chicago, Ind.
Hyman Viener & Sons, 5300 Hatcher, Richmond, Va.
White Bros. Smelting Corp., Richmond & Hedley Sts., Philadelphia 37, Pa.

Insulation

Quigley Company, Inc., 527 Fifth Ave., New York 17, N. Y.
Tennessee Products & Chemical Corporation, American National Bank Bldg., Nashville, Tenn.

Laboratory and Scientific Equipment

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Illinois.
Despatch Oven Co., 619 Eighth St., S. E., Minneapolis 14, Minn.
Eastman Kodak Co., 343 State St., Rochester, N. Y.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.

Laboratory Service

Charles C. Kawin Co., 431 S. Dearborn St., Chicago 5, Ill.
Metlab Co., 1000 Mermaid Lane, Philadelphia.

Ladle Linings • Fitted

Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22, Pa.

Ladle Linings • Plastic

Alpha-Lux Co., Inc., 155 John St., New York 1, N. Y.
G. & W. H. Corson, Inc., Plymouth Meeting, Pa.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
The Ironton Fire Brick Co., Ironton, Ohio.
Laclede-Christy Co., 1711 Ambassador Bldg., St. Louis, Mo.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Pittsburgh Metals Purifying Corp., 1352 Marvista St., N.S., Pittsburgh 12, Pa.
The Ramtite Co., Div. of the S. Obermayer Co., 2563 W. 18th St., Chicago, Ill.

Ladles

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
The J. S. McCormick Co., 25th St. & A.V.R.R., Pittsburgh 22, Pa.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., 1800 - 18th Street, Detroit 16, Mich.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Magnetic Separators

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wisc.
Houghland & Hardy—Hardy Sand Co., Evansville, Ind.

Magnets • Lifting

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wisc.

Magnets

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wisc.

Matchplates

Accurate Match Plate Co., 1847-51 W. Carroll Ave., Chicago 12, Ill.
Carlson Pattern Shop, Inc., 616 Berkshire Avenue, Springfield, Massachusetts.
City Pattern Foundry & Machine Co., 1161 Harper at Rivard, Detroit 11, Mich.
Plastic Corp. of Chicago, 2444 S. Central Ave., Cicero 50, Ill.
Pressure Match Plate Co., Inc., 1013-15 N. Front St., Philadelphia 23, Pa.
Scientific Cast Products Corp., 1390 E. 40th St., Cleveland, Ohio.

Metallizing Equipment

Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24, Ill.

Metallographic Equipment

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Illinois.

Meters • Air Velocity

Illinois Testing Laboratories, Inc., 420 N. La-Salle St., Chicago, Ill.

Mills • Reclaiming

Severance Tool Ind., Inc., Saginaw, Mich.

Milling Cutters

Severance Tool Ind., Inc., Saginaw, Mich.

Mold Conveyors

Chain Belt Company, 1725 West Bruce Street, Milwaukee 4, Wisconsin.
The Fellows Corp., 1012 N. Third St., Milwaukee 3, Wisc.
The Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Company, 300 W. Pershing Road, Chicago 1, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Palmer-Bee Co., 1701 Poland Ave., Detroit 12, Mich.

Mold Ovens and Dryers

Despatch Oven Co., 619 Eighth St., S. E., Minneapolis 14, Minn.
The Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.

Molding Machines

The Adams Company, 100 East 4th Street, Dubuque, Iowa.
Arcade Mfg. Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee, Wisc.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
The Fellows Corp., 1012 N. Third St., Milwaukee 3, Wisc.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 1201 North 12th St., La Grange Park, Ill.
The Johnston & Jennings Co., 877 Addison Rd., Cleveland, Ohio.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
Wm. H. Nicholls Co., Inc., 126 St. & 91st Ave., Richmond Hill, N. Y.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
SPO Incorporated, 7500 Grand Division Ave., Cleveland, Ohio.
The Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35, Pa.

Monorail and Tramrail Systems

Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., 1155 W. 283rd St., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Palmer-Bee Co., 1701 Poland Ave., Detroit 12, Mich.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Oils • Lubricating

Delta Oil Products Co., 6263 N. Cedarburg Rd., Milwaukee 9, Wisc.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Penola, Inc., 221 N. La Salle St., Chicago 1, Ill.

Ovens • Annealing and Heat Treating

Despatch Oven Co., 619 Eighth St., S. E., Minneapolis 14, Minn.
The Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Whiting Corp., 15628 Lathrop Ave., Harvey, Ill.

Oxygen

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.
The Linde Air Products Company, Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Patterns

Carlson Pattern Shop, Inc., 616 Berkshire Avenue, Springfield, Massachusetts.
Precision Pattern Works, 5269 W. Grand Ave., Chicago, Ill.
Pressure Match Plate Co., Inc., 1013-15 N. Front St., Philadelphia 23, Pa.

Pattern Coatings and Finishes

The Kindt-Collins Co., 12641 Elmwood Ave., Cleveland, Ohio.
Wellman Products Co., 1444 E. 49th St., Cleveland 3, Ohio.

Pattern Compound

Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.

Pattern Lumber

Dougherty Lumber Co., 4300 E. 68th, Cleveland 5, Ohio.
The Kindt-Collins Co., 12641 Elmwood Ave., Cleveland, Ohio.

Pattern Plates

Carlson Pattern Shop, Inc., 616 Berkshire Avenue, Springfield, Massachusetts.
Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Dougherty Lumber Co., 4300 E. 68th, Cleveland 5, Ohio.
The Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
The Kindt-Collins Co., 12641 Elmwood Ave., Cleveland, Ohio.
The PMS Co., 1071 Power Ave., Cleveland 14, Ohio.
Scientific Cast Products Corp., 1390 E. 40th St., Cleveland, Ohio.
Wellman Products Co., 1444 E. 49th St., Cleveland 3, Ohio.

Pattern Shop Equipment and Supplies

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
The Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
The Kindt-Collins Co., 12641 Elmwood Ave., Cleveland, Ohio.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
The PMS Co., 1071 Power Ave., Cleveland 14, Ohio.
Wellman Products Co., 1444 E. 49th St., Cleveland 3, Ohio.

Photographic Materials • Metallography

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Illinois.
Eastman Kodak Co., 343 State St., Rochester, N. Y.

Pig Iron

Hickman, Williams & Co., 1500 Walnut St., Philadelphia 2, Pa.
Tennessee Products & Chemical Corporation, American National Bank Bldg., Nashville, Tenn.

Pig Iron • Alloy

The Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro-Metals Co., 429 South 4th St., Keokuk, Iowa.

Plaster

Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.

Pneumatic Tools

Buckeye Tools Corp., 29 W. Apple Street, Dayton, Ohio.
Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Texas.
The Dallett Company, Mascher at Lippincott St., Philadelphia, Pa.
Dayton Pneumatic Tool Company, P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Independent Pneumatic Tool Co., 175 North State St., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Master Pneumatic Tool Co., Inc., Orwell, O.
The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

Porosity Equipment and Sealers

Metallizing Company of America, 3520 W. Carroll Ave., Chicago 24, Ill.
Tincher Products Corp., 1715 W. Lake St., Chicago 12, Ill.

Portable Tools • Air

Buckeye Tools Corp., 29 W. Apple Street, Dayton, Ohio.
Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Texas.
Dayton Pneumatic Tool Company, P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

Portable Tools • Electric

Buckeye Tools Corp., 29 W. Apple Street, Dayton, Ohio.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7, Ohio.
The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
The Standard Electrical Tool Co., 2488-96 River Rd., Cincinnati 4, Ohio.
Syntron Co., 545 Lexington, Homer City, Pa.

Power Units

The Ready-Power Co., 3826 Grand River Ave., Detroit 8, Mich.

Protective Coatings (Industrial)

Tousey Varnish Co., 520 W. 25th St., Chicago 16, Ill.

Pyrometers • Immersion

The Foxboro Co., Neponset Ave., Foxboro, Mass.
Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago, Ill.
The Pyrometer Instrument Co., Inc., Bergenfield, N. J.
Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.

Pyrometers • Optical

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Illinois.
The Pyrometer Instrument Co., Inc., Bergenfield, N. J.

Radium

Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

Rammers • Pneumatic

Cleco Division of the Reed Roller Bit Company, P. O. Box 2119, Houston 1, Texas.
Dayton Pneumatic Tool Company, P. O. Box 747, 8-10 Norwood Ave., Dayton, Ohio.
Master Pneumatic Tool Co., Inc., Orwell, O.
The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm, Inc., West Chester, Pa.

Refractories

Alpha-Lux Co., Inc., 155 John St., New York 7, N. Y.
The Carborundum Company, Niagara Falls, New York.
The Cleveland Quarries Company, 1740 E. Twelfth St., Cleveland 14, Ohio.
G. & W. H. Corson, Inc., Plymouth Meeting, Pa.
Jos. Dixon Crucible Co., Jersey City 3, N. J.
Eastern Clay Products, Inc., Jackson, Ohio.
Electro Refractories & Alloys Corp., 344 Delaware Ave., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
The Ironton Fire Brick Co., Ironton, Ohio.
Laclede-Christy Co., 1711 Ambassador Bldg., St. Louis, Mo.
Lava Crucible Co., 627 Wabash Bldg., Pittsburgh 22, Pa.
National Crucible Co., Mermaid Lane & Queen St., Philadelphia 18, Pa.
National Foundry Sand Co., 2970 W. Grand Blvd., Detroit 2, Mich.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Phila. 24, Pa.
The Pyro Refractories Co., Oak Hill, Ohio
Quigley Company, Inc., 527 Fifth Ave., New York 17, N. Y.
The Ramtite Co., Div. of the S. Obermayer Co., 2563 W. 18th St., Chicago, Ill.
Ross-Tacony Crucible Co., Robbins & Milnor Sts., Tacony, Philadelphia 35, Pa.
Frederic B. Stevens, Inc., 1800 - 18th Street, Detroit 16, Mich.

Respirators

American Optical Company, 14 Mechanic Street, Southbridge, Mass.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7, Ohio.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn 1, N. Y.
Safety Clothing & Equipment Company, 7016 Euclid Ave., Cleveland 3, Ohio.

Riddles and Screens

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Great Western Mfg. Co., 208-220 Choctaw St., Leavenworth, Kan.

Safety Clothing and Equipment

American Optical Company, 14 Mechanic Street, Southbridge, Mass.
Clersite Company, 2508 W. Van Buren St., Chicago, Ill.
Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn 1, N. Y.
Reece Wooden Sole Shoe Co., 2207 - 11th St., Columbus, Neb.
Safety Clothing & Equipment Company, 7016 Euclid Ave., Cleveland 3, Ohio.
A. Schrader's Son, Div. of Scovill Manufacturing Co., Inc., 470 Vanderbilt Avenue, Brooklyn 17, N. Y.

Sand • Blast

Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26, Mich.
Houghland & Hardy—Hardy Sand Co., Evansville, Ind.
Manley Sand Co., Rockton, Ill.
National Pulverizing Co., Millville, N. J.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust Street, Philadelphia, Pa.
Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11, N. Y.

Sand • Core and Mold

Ayers Mineral Company, Masonic Temple, Zanesville, Ohio.
Carpenter Brothers, Inc., 606 West Wisconsin Avenue, Milwaukee 3, Wisconsin.
Central Silica Co., Zanesville, Ohio.
Delhi Foundry Sand Co., 6326 River Road, Cincinnati, Ohio.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26, Mich.
Hickman, Williams & Co., 1500 Walnut St., Philadelphia 2, Pa.
Houghland & Hardy—Hardy Sand Co., Evansville, Ind.
Manley Sand Co., Rockton, Ill.
The Millwood Sand Co., Masonic Temple, Zanesville, Ohio.
National Foundry Sand Co., 2970 W. Grand Blvd., Detroit 2, Mich.
National Pulverizing Co., Millville, N. J.
New Jersey Silica Sand Co., Box 71, Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.
George F. Pettinos, Inc., 1206 Locust Street, Philadelphia, Pa.
Taggart Brimfield Co., Inc., P. O. Box 272, Hammonton, N. J.
Whitehead Brothers Co., 324 W. 23rd Street, New York 11, N. Y.

Sand Blast Equipment

Alloy Metal Abrasive Co., 311 West Huron Street, Ann Arbor, Michigan.
American Wheelabrator & Equipment Corp., 630 South Byrkit St., Mishawaka, Indiana.
The Macleod Co., 2232-40 Bogen St., Cincinnati 22, Ohio.
Pangborn Corporation, Hagerstown, Md.
Safety Clothing & Equipment Company, 7016 Euclid Ave., Cleveland 3, Ohio.
The W. W. Sly Manufacturing Co., 4700 Irwin Ave., Cleveland 2, Ohio.

Sand Control and Testing Equipment

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.

Sand Handling and Conditioning Equipment

Allis Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee, Wis.
The C. O. Bartlett & Snow Company, 6200 Harvard Avenue, Cleveland, Ohio.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
Bell Aircraft Corp., Prime Mover Division, P. O. Box 1, Buffalo 5, New York.
Chain Belt Company, 1725 West Bruce Street, Milwaukee 4, Wisconsin.
The Frank G. Hough Co., Libertyville, Ill.
The Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Material Movement, Industries, Inc., 9257 Laramie, Skokie, Ill.
The Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.
Palmer-Bee Co., 1701 Poland Ave., Detroit 12, Mich.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.

Sand Mixers

Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
Blystone Div., Standard Sand & Machine Co., 549 W. Washington Blvd., Chicago 6, Ill.
Clearfield Machine Co., Box 249, Clearfield, Pa.
The Fordath Engineering Co., Ltd., Hamblet Works, Albion Road, West Bromwich, Staffordshire, England.
The Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
The Moulders' Friend, Dallas City, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.

Sand Reclamation

Butler Bin Co., Waukesha, Wis.
Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wisc.
The Hydro-Blast Corp., 2550 N. Western Ave., Chicago, Ill.
Invincible Vacuum Cleaner Mfg. Co., 14th & Davis St., Dover, Ohio.
The Jeffrey Mfg. Co., 977 N. Fourth St., Columbus 16, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

Saws • Metal Cutting

Capewell Manufacturing Co., 60 Governor Street, Hartford 2, Conn.
The DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Martindale Electric Co., 1347 Hird Ave., Cleveland 7, Ohio.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
Wellman Products Co., 1444 E. 49th St., Cleveland 3, Ohio.

Saws • Woodworking

The DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.

Separators

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wisc.
Jas. A. Murphy & Co., Fifth and Vine Sts., Hamilton, Ohio.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
The Tabor Manufacturing Co., 6224 Tacony St., Philadelphia 35, Pa.

Shake-out Machinery

Allis Chalmers Mfg. Co., 1126 S. 70th St., Milwaukee, Wis.
Beardsley & Piper Company, 2424 N. Cicero Ave., Chicago.
The Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J.
Royer Foundry & Machine Co., 158 Pringle St., Kingston, Pa.
Simplicity Engineering Co., Durand, Mich.

Shock Absorption Materials

Raybestos-Manhattan, Inc., 61 Willett, Passaic, N. J.

Shot and Grit

The American Steel Abrasives Co., Sherman & East Sts., Galion, Ohio.
Carpenter Brothers, Inc., 606 West Wisconsin Avenue, Milwaukee 3, Wisconsin.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
The Globe Steel Abrasive Co., 238 First Ave., Mansfield, Ohio.
Great Lakes Foundry Sand Co., 720 United Artists Bldg., Detroit 26, Mich.
Hickman, Williams & Co., 1500 Walnut St., Philadelphia 2, Pa.
Pennsylvania Foundry Supply & Sand Co., Ashland below E. Lewis Sts., Phila. 24, Pa.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.
Steel Shot & Grit Co., Inc., 39 Warren Bridge, Boston 14, Mass.
Steel Shot Producers, Inc., Box 67, Butler, Pa.

Silica Flour

National Pulverizing Co., Millville, N. J.
Ottawa Silica Co., Box 437, Ottawa, Ill.

Spectographic Equipment

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Illinois.
Eastman Kodak Co., 343 State St., Rochester, N. Y.

Temperature Control and Recording Devices

The Foxboro Co., Neponset Ave., Foxboro, Mass.
Illinois Testing Laboratories, Inc., 420 N. La-Salle St., Chicago, Ill.

Thermocouples

The Foxboro Co., Neponset Ave., Foxboro, Mass.
Illinois Testing Laboratories, Inc., 420 N. La-Salle St., Chicago, Ill.
Tamms Silica Co., 228 No. La Salle St., Chicago, Ill.

Tote Boxes and Barrels

The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.

Tractors and Trucks

Bell Aircraft Corp., Prime Mover Division, P. O. Box 1, Buffalo 5, New York.
Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.

Tumbling Barrels • Dry

N. Ransohoff, Inc., 16 E. 72nd St., Cincinnati 16, Ohio.
The W. W. Sly Manufacturing Co., 4700 Irwin Ave., Cleveland 2, Ohio.

Tumbling Barrels • Wet

N. Ransohoff, Inc., 16 E. 72nd St., Cincinnati 16, Ohio.

Vacuum Cleaning Equipment

Invincible Vacuum Cleaner Mfg. Co., 14th & Davis St., Dover, Ohio.
Roots-Connersville Blower Corp., 900 West Mount St., Connersville, Ind.
Spencer Turbine Co., 486 New Park Avenue, Hartford 6, Conn.
U. S. Hoffman Machinery Corp., 99 Fourth Ave., New York 3, N. Y.

Ventilating Systems

The Kirk & Blum Mfg. Co., 2876 Spring Grove, Cincinnati, Ohio.
Powermatic Ventilator Co., 4019 Prospect Ave., Cleveland 3, Ohio.
H. H. Robertson Co., 2400 Farmers Bank Bldg., Pittsburgh 22, Pa.
Claude B. Schneible Co., 2827 - 25th Street, Detroit, Mich.

Vibrators

Arcade Mfg. Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis.
The Cleveland Vibrator Co., 2828 Clinton Ave., Cleveland 13, Ohio.
Crescent Machine Div., Rockwell Mfg. Co., 600 E. Vienna, Milwaukee, Wisc.
The Dallett Company, Mascher at Lippincott St., Philadelphia, Pa.
Davenport Machine & Foundry Co., 1628 W. Fourth St., Davenport, Iowa.
Herman Pneumatic Machine Co., 1806 Union Bank Bldg., Pittsburgh 22, Pa.
Martin Engineering Co., 704 Rose St., Kewanee, Ill.
The Osborn Manufacturing Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
SPO Incorporated, 7500 Grand Division Ave., Cleveland, Ohio.
Simplicity Engineering Co., Durand, Mich.
Syntron Co., 545 Lexington, Homer City, Pa.

Wash Room Equipment

Bradley Washfountain Co., 2203 W. Michigan Street, Milwaukee, Wis.

Welding and Cutting Equipment

Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Penna.
The Linde Air Products Company, Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Welding Rods

Arcos Corporation, 1500 South 50th Street, Philadelphia 43, Penna.
Haynes Stellite Co., Union Carbide and Carbon Corp., Kokomo, Ind.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
The Linde Air Products Company, Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Wheelbarrows

Bell Aircraft Corp., Prime Mover Division, P. O. Box 1, Buffalo 5, New York.
Sterling Wheelbarrow Co., 7036 W. Walker St., Milwaukee 14, Wis.

Woodworking Machinery

The Kindt-Collins Co., 12641 Elmwood Ave., Cleveland, Ohio.
Oliver Machinery Co., 1025 Clancy Ave. N.E., Grand Rapids 2, Mich.
Wellman Products Co., 1444 E. 49th St., Cleveland 3.

X-Ray Equipment

Eastman Kodak Co., 343 State St., Rochester, N. Y.
General Electric X-Ray Corp., 4855 W. McGeoch, Milwaukee 14, Wis.

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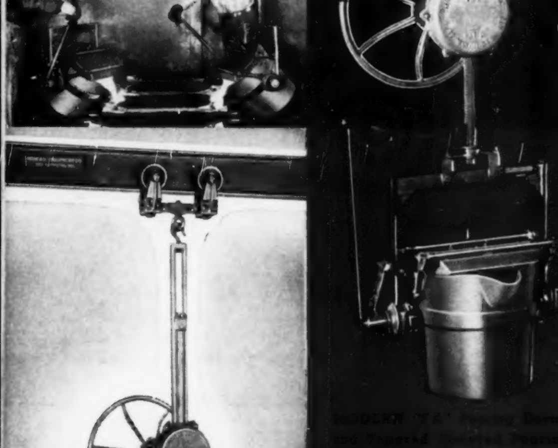

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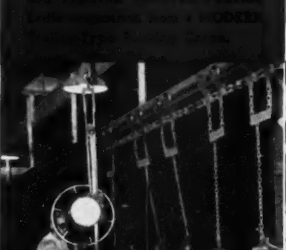

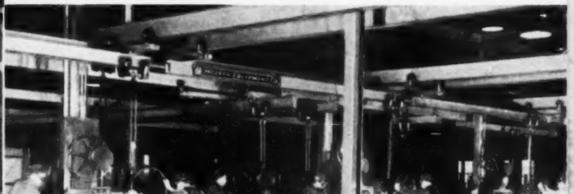

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